THE INDEPENDENT GUIDE TO PERSONAL COMPUTING APRIL 9, 1996 VOL. 15 NO. 7 U.S. $3.95 / CAN. $4.95 / U.K. £2.95 ZD

PC MAGAZINE

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133-MHz Pentium Portables From AST and Micron

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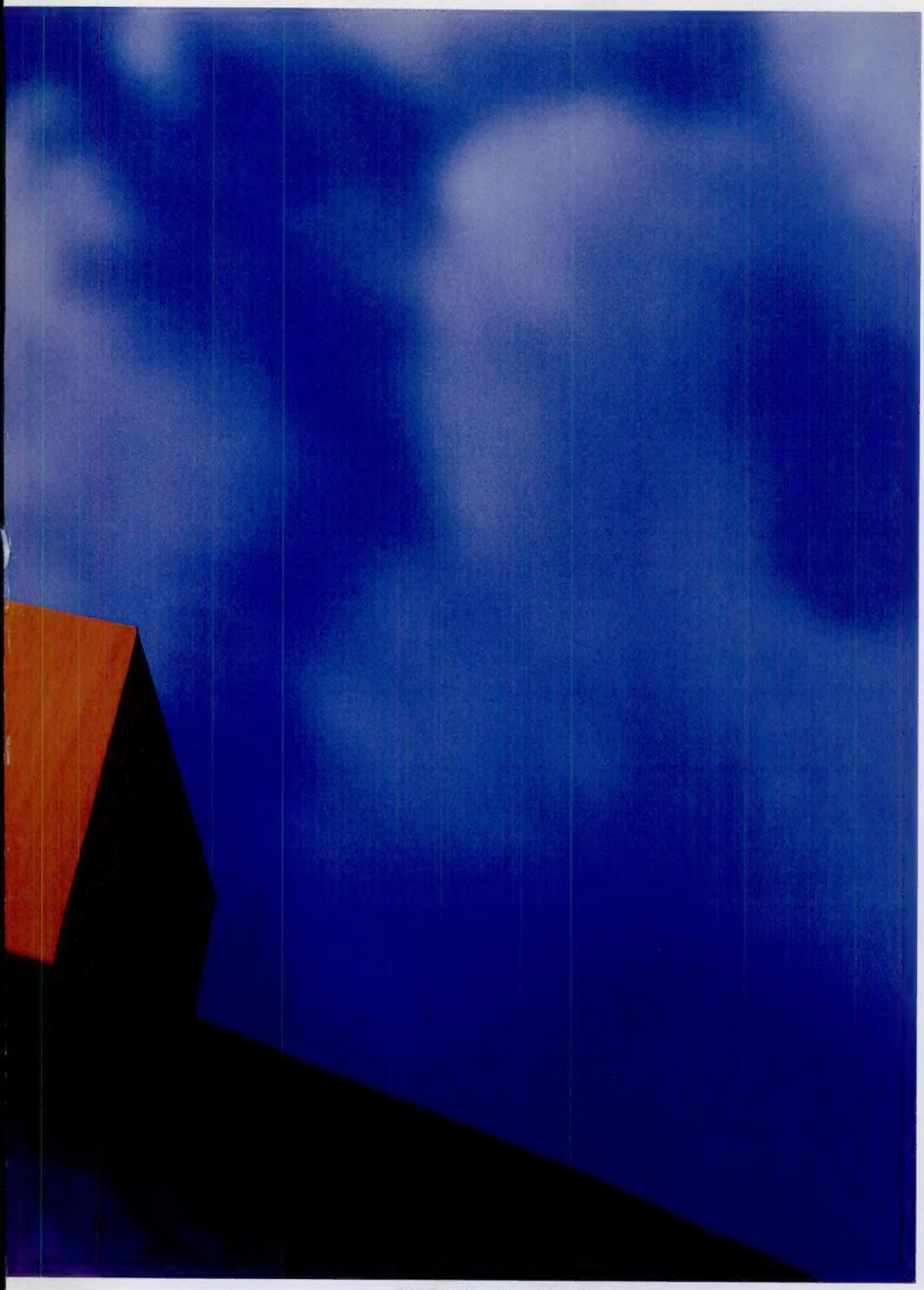

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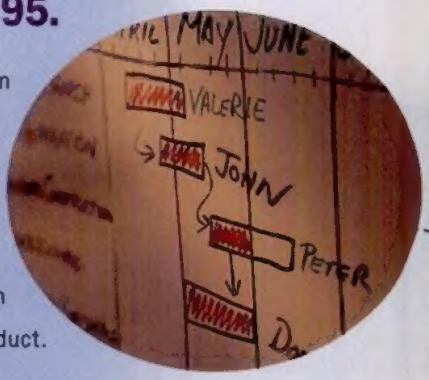

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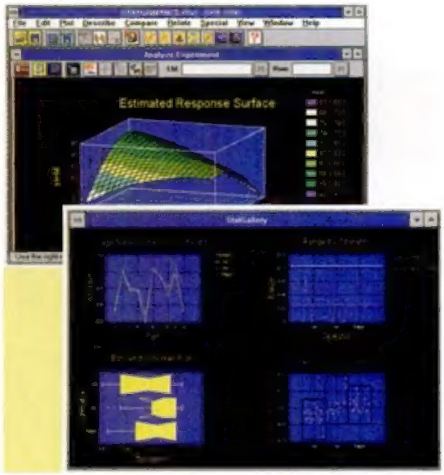

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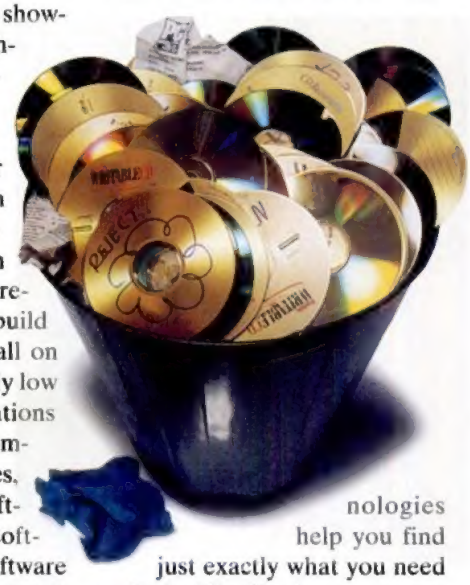
Inside

The history of the personal computer is a story about taking tools that used to be in the province of specialists and making them available to individuals.

Spreadsheets brought financial analyis to the masses. Desktop-publishing packages let people create and print newsletters and brochures without having to spend thousands of dollars. More recently, advances in the Internet have let PC users who have something to say create Web pages that can be viewed by anyone in the world.

The stories in this issue showcase other areas where technology is letting individuals do what only big organizations could do before. Our three-part cover story, "Create Your Own CD," shows how individuals and small businesses can author multimedia titles, create training software, or build databases and put them all on CDs, starting at a relatively low price. Our product evaluations look in-depth at CD-R (compact disk–recordable) drives, multimedia authoring software, and CD-creation software. The hardware and software required is getting better, but it still has a ways to go. In our testing at PC Labs, we created dozens of original CDs that worked great—but even more that didn't work at all.

Gone also are the days when only monolithic news organizations could dictate the headlines you would read in the morning paper. Our feature story "Choose Your News" takes a look at a total of 27 services designed to let you choose the news topics you're interested in and have related stories delivered to you via custom software, through the World Wide Web or directly into your e-mailbox. These hot new technologies help you find just exactly what you need to find while filtering out everything you don't need. And some of them are absolutely free.



PHOTOGRAPHY BY THOM O' CONNOR

Flip through this issue and you'll be reminded once again why we we call these machines *personal* computers: They take difficult or seemingly impossible tasks and make them personal, doable, and affordable.

—*Michael J. Miller*

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COVER STORY

Create Your Own CD

BY JIM SEYMOUR

CD-ROM drives are now standard equipment on most PCs. But until recently, there has been no easy, affordable way to create CD-ROM disks at your desktop. Now the hardware is getting cheaper and the software easier to use. In this issue, we take a close look at the three elements you'll need to start producing your own CD applications: authoring tools to create professional-caliber multimedia applications such as training disks and interactive catalogs, mastering software to perform data archiving and prepare your files for recording, and the CD recorders themselves. From initial idea to final disk, we show you the steps.....99

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COVER STORY

Create Your Own CD

CD-R Drives

BY JOHN R. QUAIN A few years ago, CD recorders weren't considered desktop tools—they were the *size* of desks. Now that a CD-R drive can fit in your PC's drive bay and can cost less than $1,000, the technology looks poised to turn every computer into a CD-ROM publishing house. As the hardware has become more affordable, the software for mastering a disk has grown more approachable, so even novice users can start creating CD backups and multimedia apps. We put 19 CD-R subsystems through a rigorous round of tests to determine which will suit your needs.....**107**

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Multimedia Authoring Tools

BY LINDA AND ERICK VON SCHWEBER
Have you ever thought about making your own multimedia CD-ROM? Today's multimedia authoring software packages offer seamless graphical user interfaces, handy drag-and-drop features, and even tools for kiosk creation and computer-based training. We review nine multimedia authoring products and prove that high-quality audio and video creation needs so little expertise that mere mortals can develop cool multimedia apps.....**149**

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Create Your Own CD: Premastering Software

BY JON HILL
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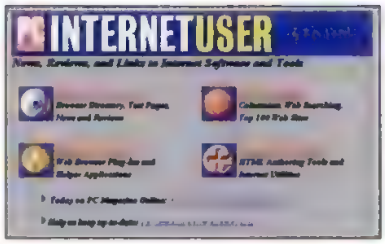

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Our **InternetUser** site is a Web wanderer's dream come true. It's the first place you should look for the latest information on the Internet. **Browser Central** has a browser directory, test pages, and the latest news and reviews; **Web Central** has columns, Web searching, and the Top 100 Web Sites; **Plug-in Central** has a comprehensive list of Web plug-ins and helper apps; **Internet Toolkit** has HTML authoring tools and Internet utilities.

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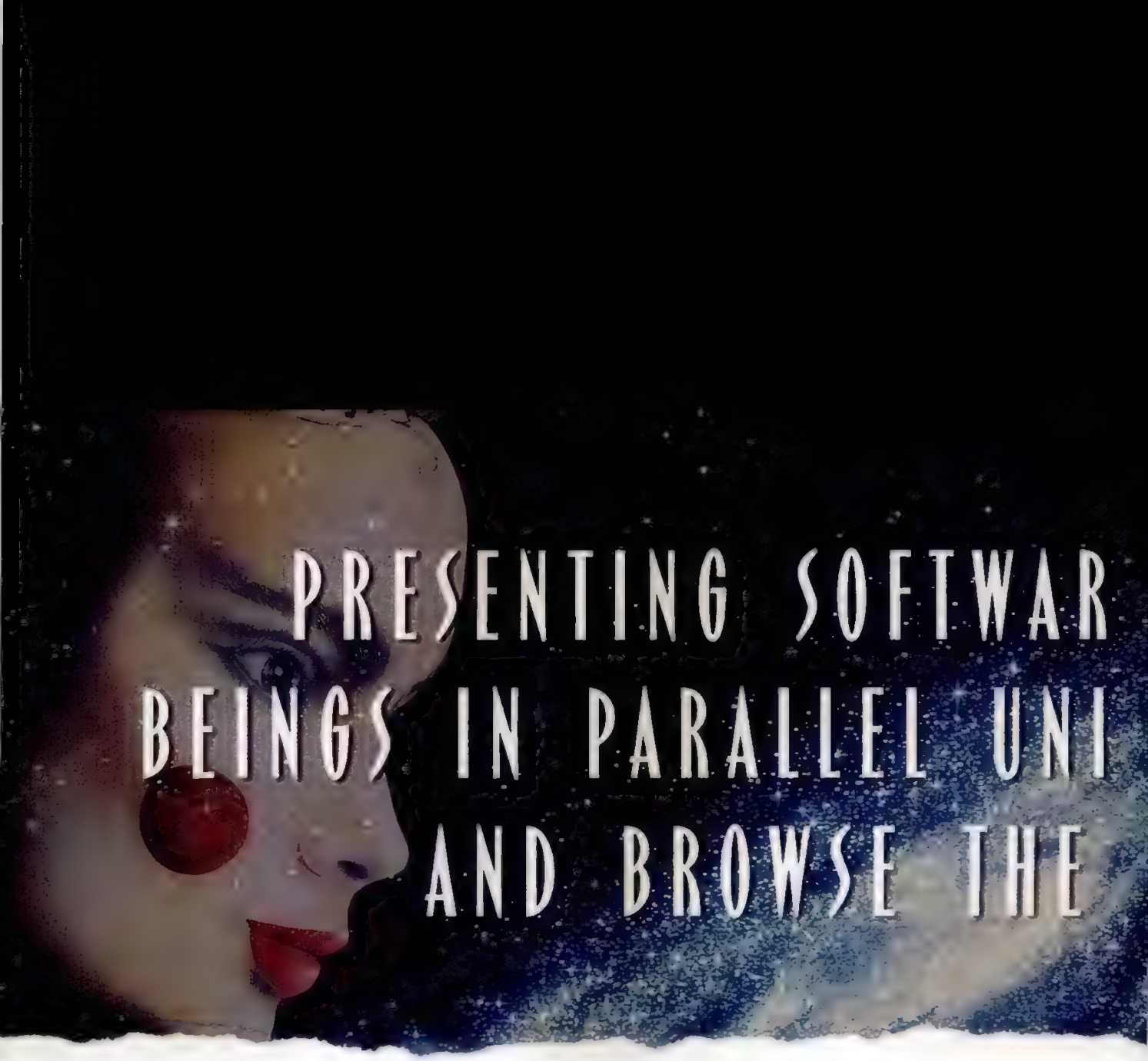
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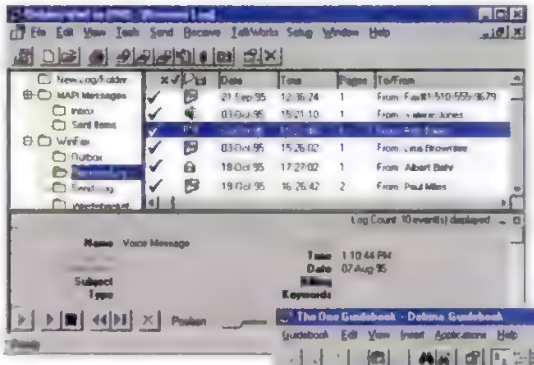

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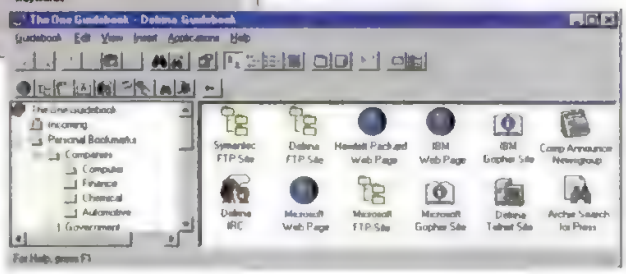

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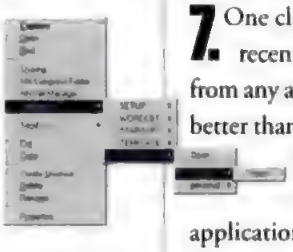
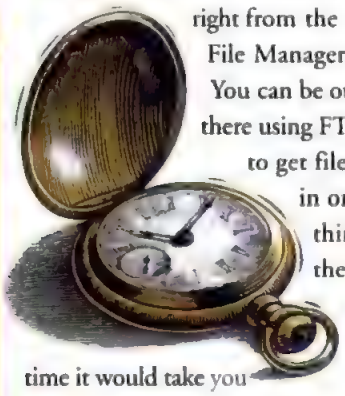


3. Compress a file. Our built-in PK-Zip compatible compression saves you a minute every time.

4. Use Norton Navigator to plug into your Internet connection right from the File Manager. You can be out there using FTP to get files in one third the time it would take you with a separate application.



5. Try a word search for "profits" or any other text string within files. It's at least ten times faster on average with Norton Navigator. No matter how many files you have. Or how big they are. In fact, the bigger the files, the more time you'll save.

6. Save another minute every time you delete, move, zip, or encrypt from any application's Open or Save dialog box. (Are you keeping count?)

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Windows Magazine, 8/95

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PC Magazine, Editors' Choice, 11/21/95

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PC Magazine, 1/9/96

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Letters

WINDOWS OR BUST?

I was surprised by the cover story of your issue of December 5, 1995, "The Top 103 Windows Machines." Is there a new breed of PCs that works only with Windows? As far as I know, each of the 103 PCs reviewed can work with DOS, Linux, and, yes, even OS/2. I would also like to recommend that for future product comparisons, you include one or two native OS/2 or Linux equivalents. As we all know, there are PC users using operating systems other than Windows 3.*x* and Windows 95. Your attention to that group of users would be greatly appreciated.

T.T. CHUA
via the Internet

I have been an avid *PC Magazine* reader for years. When I purchased my current computer (a 386/20) I pored over the reviews in *PC Magazine* until I found the best system at the best price. Now, almost seven years later, I need to upgrade. So again, I spent the better part of a weekend poring over the reviews of Pentium PCs in your issue of December 5, 1995. I have not seen such a poorly architected bunch of systems since the original 386 came out. The architecture that most Pentium systems are built on is the Triton chip set. This chip set does not and will never support the DRAM technology that will be needed for Pentium Pro systems. So here we are in 1995, with the Pentium Pro and its true 32-bit architecture, ready for 200 MHz and beyond but with no way to get there short of assigning this year's purchase to the dumpster in the not-too-distant future.

SCOTT GONGWER
via the Internet

If *PC Magazine* has one particularly annoying trait, it's the tendency to disregard real-life budgetary concerns when it comes to recommending equipment. For example, in your issue of December 5, 1995, you state that "it no longer makes sense to buy a 486-based PC." But I remember that for at least a year after your magazine had similarly proclaimed the 386-based PCs obsolete, they were still a reasonable choice for the budget-constrained. I know you guys mean well, but could you try to be just a little bit conscious of the less well-heeled out here?

BERNIE CONNEELY
Charlestown, Massachusetts

William P. Flanagan's article "...Out like a Lamb?" makes a point I strongly agree with. Where is it written that every PC user has to upgrade to Windows 95? His emphasis on corporations not wanting to upgrade also applies to individual PC users. Having to purchase new hardware and software every year or two is not my idea of having a well-maintained PC. My idea of a well-maintained PC is to upgrade components when they no longer do the job they are supposed to; for example, when the hard disk fails or when more RAM is needed. At a time when we should be cutting costs, does it really make sense to continually upgrade our PC systems every time some new technology comes on the market? I think not, especially when what we already have does the job to our satisfaction.

The emphasis on corporations not wanting to upgrade applies to individuals as well.

PATRICK G. HORNEKER
Valparaiso, Indiana

Thanks to William P. Flanagan for a timely piece comparing PCs from numerous manufacturers based upon home usage. As a user of a NeXT computer system who could not accept Windows 3.*x* as a real user interface, Windows 95 seems finally to be something that the whole family can learn to use and enjoy. I was shopping for a PC at the time this article came out, and it helped confirm the choices I made relating to system configuration. Thanks again for a timely, great review that saved me money.

HARRIS S. TARGOVNIK
via the Internet

I think that articles similar to "In like a Lion..." and "...Out like a Lamb?" (December 5, 1995), which reviewed the top OS/2 systems, would be very helpful. Due to the lack of good support for OS/2 of some hardware vendors, the compatibility of systems—even those preloaded with OS/2—varies greatly. It would be interesting and useful to find out which systems work well and which ones have compatibility problems.

ROBERT SIMPSON
via PC MagNet

WINDOWS AND BEYOND

I thought that your review of graphics accelerators ("Display Mates," December 5, 1995) was typically superb—with one exception. Although you mentioned Windows 95 support, you did not base your ratings on the availability of Windows 95 drivers. As a result, an unsuspecting Windows 95 user might venture out in search of a Diamond Stealth 64 Video card, for example, only to find that there are no drivers available.

TED BRENGEL
via the Internet

I play a good number of DOS-based games on my PC, as I am sure many of your subscribers do, so I was extremely disappointed in your latest review of video cards. Gamers are very interested in graphics performance, because games push this performance more than almost any other kind of application. It is an unfortunate fact that many graphics boards that accelerate Windows very well perform poorly under DOS. I want a graphics board with top-notch VGA performance under DOS and the best performance I can get under Windows. The limited information in your review concerning DOS is useless in helping me select a video board that works well in the environment I use most of the time. Sure, almost all business applications now run under Windows, but do word processor or spreadsheet users really care whether their new video boards are 15 percent faster than their old ones? Probably not as much as a DOOM fan trying to get the most frames per second from his PC.

STUART PIERCE
via PC MagNet

BEAT THE CLOCK

I loved Jake Kirchner's Pipeline column "Night of the Living Dread" (December 5, 1995). We have four clocks in the kitchen: One is on East Cherry Hill time, one on West Cherry Hill time, one on North Cherry Hill time, and the last on South Cherry Hill time. Not one of these digital clocks agrees with another. I've always wondered if the digital clock was a blessing or a curse. It was a great surprise when Windows 95 automatically adjusted to standard time. Now if I could get the other umpteen clocks in the house (the thermostat, the microwave, the two VCRs, the seven bedroom

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Letters

clocks) to set themselves. Why can't we just stay on daylight savings time?

HOWARD S. YARES
via PC MagNet

I enjoyed Kirchner's column "Night of the Living Dread." Both Sanyo and Fisher make VCRs that will update the time so that you do not have to worry about the wrong time. Also, my phone used to tell me what time the messages were recorded, a helpful way to find out if people called when they said they did.

DAVID FEATHERMAN
via the Internet

AND THE WINNER IS. . .

I enjoyed Bill Machrone's column "What Use is the World Wide Web?" (December 5, 1995). I feel there is great potential out there for the daily electronic newspaper with the content of Individual's First! and the 3D color and video graphics of a Java Web site. The winner will be someone who figures out how to license and distribute content at a realistic price.

BILL COPENHAVEN
Boise, Idaho

SIMM STORIES

I am writing in response to Bill Machrone's Second Looks column, "All that Glitters: Gold SIMMs Lose Their Shine" (December 5, 1995), regarding dissimilar conductor materials used in memory connections. I have found the symptoms Machrone described in systems with similar and dissimilar connector materials, and I believe the real and only cause is the inherent limitation of a mechanical connection and not the connectors' electrochemical properties. Upon insertion, a perfectly gas-tight connection between the socket pins and SIMM's edge connectors should result. But rarely does this occur, regardless of whether the connector materials are identical or not.

WILLIAM J. SACKIN
Mt. Lebanon, Pennsylvania

Thanks for the Second Looks column regarding gold SIMMs. You can be sure that in future SIMM orders, I will be specific as to whether I want gold or tinned. I appreciate the alert as I never would have expected problems. As usual, *PC Magazine* is a step ahead of what vendors are trying to do to the unsuspecting PC-user community.

MICHAEL AVILA
via PC MagNet

MORE OS/2 READER SUPPORT

I agree with the shocked reader responses to IBM's potential disregard of OS/2 in Letters (December 5, 1995). OS/2 is a good product that has been around for a while. If IBM would invest the time in advertising that Microsoft has put into Windows 95, it might have better luck.

KIMO A. KUHNS
via PC MagNet

MAKING IT WORK

I want to say thank you for Neil J. Rubenking's tip in the User to User column "Enable DOS 6's File Manager Enhancements" (December 19, 1995). The information regarding the addition of Undelete to File Manager's File menu just slipped past me when upgrading to DOS 6.*x* years ago. I use Undelete frequently, and this tip will save me so much time. Thanks again, and keep those Win 3.1 tips coming.

DAVE EASTON
Phoenix, Arizona

EGG TOSS

I would like to thank Jeff Prosise for his article, "Windows 95 Secrets," the little "Easter egg" in your issue of December 19, 1995. I have had a wonderful time reading *PC Magazine*. The authors really discuss the programs well; they have helped very much.

TAL SARON
via the Internet

In the PC Tech/Tutor section of your magazine, I read about the fashionable waste of my disk space inherent in Windows 95. I have read about the self-centered and egotistical practice of planting "Easter eggs" in major applications and operating systems before, and I find it appalling. If the Code Gods in Redmond want a pat on the back so badly, why not produce the best practical operating system with a minimum of undocumented features? *PC Magazine* did its job by reporting how to start the presentation. Now when do I get to read about how to get rid of it?

MICHAEL LOHMAN
via the Internet

IT'S ALL GREEK TO ME

Your issue of December 19, 1995, contained a PC Tech article on personal SQL products by Brian Butler. Although I found the article very informative, it contained many database terms with which I was unfamiliar. I've used databases before, but these new products seem to have many new features. It would have been nice to have some explanation for what these features are, what they are used for, and especially how they help an application developer create a better database.

RICHARD MACCHI
Attleboro, Massachusetts

CORRECTIONS AND AMPLIFICATIONS

The Toshiba XM-3701, a 6.7X CD-ROM drive (reviewed in "CD-ROM Drives: The Third Generation," January 23, 1995), was unfortunately sent to us with an 8-bit SCSI adapter—Future Domain's 850 SCSI card—rather than a 16-bit adapter. But Toshiba has been bundling and selling its CD-ROM drives with only 16-bit cards—Future Domain TMC-1610s—since September 1994. Once we hooked up the 16-bit card, the XM-3701's performance dramatically improved: Performance improved about 10 percent across the board, making the Toshiba one of the best performers in the review.

In our issue of February 6, 1996, page 118, we cited GPO Gate as one of our Top 100 Web Sites and referred to the University of California at San Diego as its founder. In actuality, the University is only one of the many gateways to the main "GPO Access" Web site, which is primarily accessible at *http://www.access.gpo.gov/su_docs*.

In our story, "Cartridge Drives: A Removable Feast" (March 12, 1996), the photos on page 186 were inadvertently switched. The photo in the upper-left corner was actually the Tahoe 230 from Pinnacle Micro, and the photo of the Panasonic PD/CD-ROM, Plasmon PD/CD Drive, and Toray Phasewriter Dual appeared in the lower-right corner.

The pricing shown for WinBook Computer Corp.'s WinBook XP5 P120 is actually the price for the WinBook XP5 P75 (New & Improved, February 23, 1996). The correct pricing for the WinBook XP5 P120 is $3,499; that configuration icludes a 10.4-inch active-matrix display, a 14.4-Kbps internal fax/modem, 16MB of RAM, an 810MB hard disk, and 256K of L2 cache. For a 1.2GB hard disk, add $300.

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MICHAEL J. MILLER

Internet Growing Pains

Growing up can be painful. Just ask any adolescent. And few things in recent memory have grown as fast as the Internet. By any measurement—the number of people online, the variety of sites, the amount of data available—the Internet has experienced explosive growth, and there's no doubt this is causing some very real strain.

I've found that accessing popular sites is becoming more difficult and time-consuming. Many are sluggish, and when downloading, pages seem to paint slowly across the screen. Sometimes links lead to defunct sites. Even worse, you get the dreaded "Server is not responding" message. Some Internet service providers are so busy that they too are reporting service interruptions.

What's a Web surfer to do? Unfortunately, there's no easy answer. Many of us have resorted to faster lines: 28.8-Kbps modems or perhaps even ISDN at home and a shared T1 line at work. But the Internet still feels slow. One reason is that it is simply becoming overcrowded. There are so many estimates of the number of Internet users out there that it's hard to know whom to believe. What we do know is that millions of people have discovered the Web in the last few years.

Estimates range from a conservative count of 7 million active users, according to publisher O'Reilly & Associates, to 26.4 million people with Internet access, according to Matrix Information and Directory Services. Furthermore, the number of users has been doubling every year since 1988, Matrix says. At the same time, the number of hosts and domains has grown dramatically. As of January, there were an estimated 9.5 million Internet hosts and 240,000 domains, according to Network Wizards. Many people say the current growth was unexpected and surely can't continue. But perhaps it's not so unbelievable after all: If you look back to 1982, you'll notice a pattern of Internet hosts doubling every year since.

Periodic doubling is a difficult concept for most people. If you agree to give someone a penny on the first day of the month and double that amount every day, on the last day of the week you'll owe only 64 cents. But on the last day of the month, you'll owe $5,368,709.12! Wait, you say, nothing can grow that fast forever. You may be right. There are some obvious limitations: If we continue doubling every year, we'll have one host for every person on the planet in another decade. But I'm reminded of Moore's Law, which says that microprocessor capabilities double every 18 months—a rule of thumb that's been borne out over the past 25 years. Neither CPU technology nor the Internet shows any signs of slowing down.

PHOTOGRAPH BY ANDY FREEBERG

CYBER JAM

Even with a fast connection, the Internet feels slow. One reason is that the Net is simply becoming too crowded.

The growth of the Internet has been uneven. Some sites are growing faster and getting busier while others remain quiet backcountry roads. The Internet has its own rush hours, and the volume of traffic varies depending on the time of day. Often, the Net becomes so overwhelmed that packets of data can get trapped in loops or are simply lost. Messages don't get delivered, and Web sites can't be accessed. Some organizations, such as Matrix, monitor these problem areas, called *storms*, on maps similar to those used for weather reports. Meteorologists can predict rain, but no one can tell exactly where lightning will strike. Similarly, we can foresee increased traffic, but we can't tell precisely when and where traffic will become so tight that nothing will get through.

So what does this mean? In part, it means that the infrastructure has to catch up with increased demand and then at least keep pace with growth—something that hasn't been happening. There's no shortage of Internet service providers (about 2,000, by some accounts), and the backbone continues to grow. The Internet is so complex, however, that no one can map the entire network anymore.

How the Internet deals with these growing pains will probably determine what kind of "information superhighway" evolves. Will we see the current Internet keep getting larger and more complicated but still operated collectively—a model that has served us well so far? Or will we see parallel, private "internets" established by service providers who install their own servers and routers and guarantee a certain quality of service? That could result in better service for some, but probably at higher prices.

Even at work, where I use a Pentium/120 with 32MB of memory and a T1 connection, I still often can't download pages at an acceptable pace. Would I pay extra for faster and more reliable service? You bet. □

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Cyrix Scores

How does a 133-MHz chip outperform a 166-MHz chip?

Confirming the new P-rating system for non-Intel microprocessors, PC Magazine Labs has reported that the Cyrix 6x86 P166+—a 133-MHz processor—slightly outperforms Intel's Pentium 166-MHz processor on several of Ziff-Davis's industry-standard benchmark tests. Two 6x86 P166+ machines (which were tested for the upcoming *PC Magazine* cover story on Pentium alternatives, May 28, 1996) produced Disk WinMark 96, Graphics WinMark 96, and Winstone 96 scores that outdistanced almost all the scores reported in our recent 150- and 166-MHz Pentium report in our issue of February 20, 1996.

The Cyrix 6x86 P166+ is one of the first processors to use the newly developed P-rating system from Advanced Micro Devices, Cyrix, IBM Microelectronics, and SGS-Thomson Microelectronics. Under the system—which lets you purchase a PC according to the overall CPU performance rating rather than mere clock speed—a processor's name compares its performance with that of a particular Pentium. A P133, for instance, would perform as well as a Pentium 133, while a P150 would equal the performance of a Pentium 150.

"P" IS FOR PERFORMANCE

MDR Labs, run by Michael Slater of the independent analyst firm MicroDesign Resources, uses Winstone 96 to determine a processor's P-rating. Although it's not part of the P-rating standard proper, vendors may add a "+" suffix to a processor's name to indicate performance that surpasses a given Pentium. Since the 133-MHz 6x86 produced better scores at MDR Labs than the Pentium 166, Cyrix tagged it with the P166+ moniker.

Initially, the P-rating system may be confusing to PC buyers who are used to identifying their processor by its clock speed, but Cyrix claims that the new naming convention will make purchases much easier. "The P-rating system was devised to make things simple, so that we'll have an apples-to-apples comparison between architectures," says Steve Tobak, vice president at Cyrix. "Users are attuned to the P number. In our case, P is performance, not Pentium. Manufacturers will see that our naming convention is the best way to go."

The two Cyrix machines tested at PC Labs produced some of the best Winstone 96 and WinBench 96 scores that PC Labs has ever seen. Winstone tests a machine's overall performance when running popular Windows applications, while WinBench tests a machine's graphics and disk subsystems. With an average Winstone score of 79 and an average Graphics WinMark score of 32.8, the two systems collectively outperformed *PC Magazine*'s Pentium 166 Editors' Choice, the SAG SFF 166, whose Winstone score of 76 and Graphics WinMark score of 32.3 were previously unprecedented. The average Pentium 166 Disk WinMark score was a considerably lower 1,110.

The two machines, however, could not measure up on PC Labs' $CPUmark_{16}$ and $CPUmark_{32}$ tests, which measure the speed of the processor subsystem under 16- and 32-bit Windows. The average scores of the systems were far below the Pentium 166 averages but still bested both the average Pentium 150 scores in our issue of February 20, 1996, and the average Pentium 133 scores in our issue of December 5, 1995.

ARCHITECTURAL ACHIEVEMENTS

The Cyrix 6x86 chip is able to overcome its slower clock speed because of significant enhancements made to its architecture. It makes use of several features that are present in the Pentium Pro but lacking in the Pentium Classic. It does not have a built-in L2 cache, but its superscalar, superpipelined architecture supports register renaming, out-of-order execution, multibranch prediction, data-dependency removal, and speculative execution. Unlike the Pentium Pro, however, the 6x86 is optimized for 16- and 32-bit Windows—meaning the P166+ offers better performance than any other processor on the mainstream desktop.

If Cyrix's plans pan out, PC buyers will surely associate the P166+ with the Pentium 166 and not with its slower clock speed.—*Cade Metz*

CPU Speed Doesn't Tell the Whole Story

A speedy processor alone doesn't always produce a top score on our benchmark tests. The architectural enhancements in the Cyrix 6x86 P166+—a 133-MHz processor—give it more processing power than a Pentium/166 processor.

Higher scores represent better performance	ZD Winstone 96	ZD Graphics WinMark 96	ZD Disk WinMark 96	ZD $CPUmark_{16}$	ZD $CPUmark_{32}$
Average Cyrix 6x86 P166+ (2 PCs)	79	32.8	1,195	293	294
Average Pentium/166 (23 PCs, 2/20/96)	68	25.0	1,110	310	309
Average Pentium/133 (41 PCs, 12/5/95)	60	20.2	1,000	266	267
SAG STF 166 (Editors' Choice, 2/20/96)	76	32.3	1,220	334	339

ILLUSTRATION BY TERRY MURA

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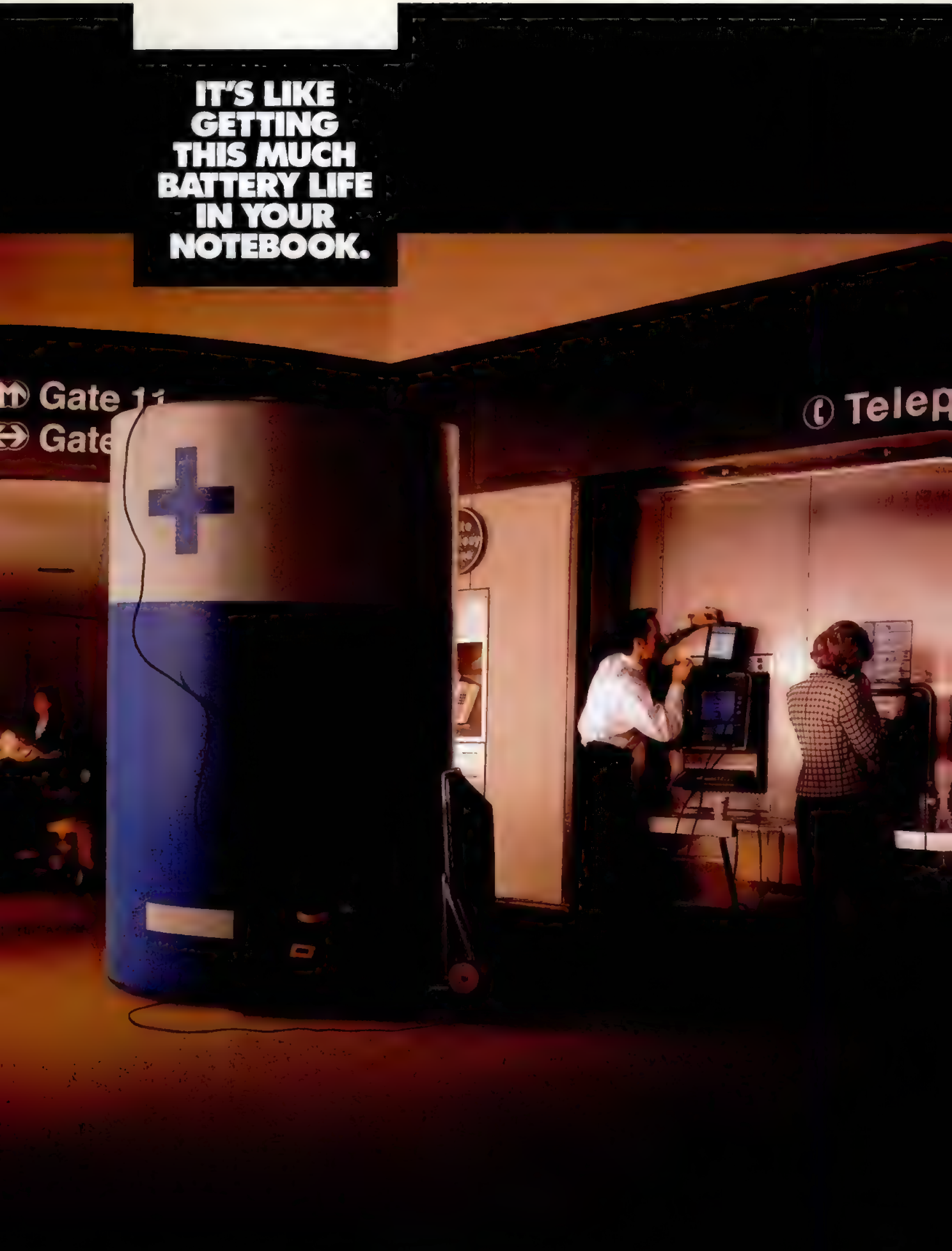
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All the News, All the Time

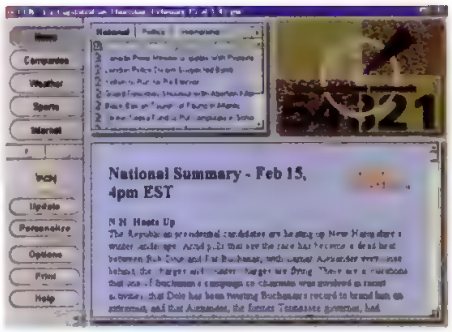
PointCast serves up online information as a ticker.

The latest Internet enhancement product to generate a buzz is PointCast, a screen saver that's linked to the Internet and designed to cull a personalized grab bag of information—news headlines, security quotes, sports scores, and weather forecasts—then display the information on-screen in lieu of standard screen-saver fare.

According to PointCast CEO Chris Hassett—formerly the head of research at Adobe—the product "combines the power of the Internet with the convenience of broadcast news to personalize information without wasting valuable time searching the Internet." Like the constantly rolling ticker tape on CNBC, PointCast's information is continuously changing, along with advertisements, which are also customized to your interests.

PointCast's software is sponsored by Electronic Data Systems, Fidelity Investments, and General Motors. The content providers that are stocking PointCast's "channels" include AccuWeather, Reuters, S&P Comstock's stock ticker, and *Variety*.

PointCast now distributes the software and information updates for free from its Web site *(http://www.pointcast.com)*, but eventually the business model will change from advertisers subsidizing the software's distribution to advertisers paying to place ads based on the software's circulation. The PointCast Network Plug-in will be written to the Netscape Navigator plug-in API, so that Navigator 2.0 users can view PointCast.



ONLINE BROADCASTING: *PointCast pops up newsfeeds and stock quotes customized to your interests.*

Although its business model and enabling technology are very different, Ex Machina's recently announced AirMedia Live! is also a one-stop front end for quickly digested online information. The Ex Machina software used an ISA board, which receives information wirelessly from all kinds of online content providers. The one key difference, though, is price. Ex Machina costs users $200 to start—with customized news feeds sending the monthly costs to $20 or more—but PointCast is free to users.—*Sebastian Rupley*

Biology Battles PC Viruses

IBM's research lab develops an immune system.

ILLUSTRATION BY JAMES YANG

You'll probably download more software this year than you did last year, and the pace is only going to pick up as you're plied daily with offers of free software on the Web. Not surprisingly, the Web also offers a convenient way for viruses to hitch a ride straight to your PC.

Researchers at IBM's Watson Research Lab in Yorktown Heights, New York, concluded back in the early eighties that as the mechanism for spreading viruses moved from floppy disks to vast networks, containing viruses would become an increasingly tough challenge. "We knew that everybody was going to get hooked up to worldwide networks. It was just a matter of time," says Steve White, senior manager of massively distributed systems. So the lab set to work developing an immune system that could protect computer data from the ever-rising birthrate of computer viruses.

The IBM team draws inspiration from biology to understand how computer viruses spread and to craft the technology to deal with them. "There are deep conceptual and mathematical connections between computer viruses and biological viruses," says White. The human immune system can find new viruses and cure the body of them. For example, once you get sick from measles, your body knows how to cure subsequent exposures. "We're working on something for cyberspace that does very much the same thing," explains White.

Top Retail Software

1. **Microsoft Windows 95 Upgrade** Microsoft
2. **Microsoft Plus! for Windows 95** Microsoft
3. **SoftRAM** Syncronys SoftCorp
4. **Netscape Navigator Personal Edition** Netscape Communications
5. **Uninstaller** MicroHelp
6. **CleanSweep 95** Quarterdeck
7. **Norton Antivirus** Symantec
8. **VirusScan** McAfee
9. **Corel Gallery** Corel
10. **Remove-It 95** Vertisoft

Source: PC Data. Data for December 1995. Additional lists at *http://www.zdnet.com/pcmag/topten/topten.htm.*

The immune system, which will be ready within two years in IBM's antivirus products, will automatically forward files to an antivirus administrator's PC at your company and then over the Internet to a secure computer back at IBM's lab. There, computers will reproduce the virus, analyze it, figure out how to detect and remove it, and send that information back to the administrator's computer and on to your desktop.

The biological analogy goes even further. If the birthrate of viruses is higher than the death rate, you'll have an epidemic. If the birthrate is smaller than the death rate, the virus will become extinct.

As it became clear that viruses could spread more quickly than humans could craft cures, it became clear that the conventional method of coping with viruses—in which analysts painstakingly reverse-engineer viruses—had to evolve. One technical challenge the IBM researchers tackled was figuring out how to extract signatures—or fingerprints—automatically. "That was largely thought impossible to do in the antivirus industry a few years ago. It turns out that computers can identify viruses and eradicate them faster than humans can," says White.

"The idea is to be able to do this quickly enough that we can spread the cure faster than the virus can spread the disease."—*Carol Levin*

Cruise the Internet as fast as modemly possible.

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Connecting Business Is Big Business

GE Interbusiness and Industry.Net unfold plans.

The landscape of business-to-business electronic commerce—connecting companies with suppliers and vendors—came more clearly into focus following announcements by two major players. GE Information Services has unveiled GE Interbusiness, which enables secure business transactions via standard Internet protocols and software already in the hands of millions of potential users. And Industry.Net, one of the largest and oldest electronic commerce providers, has hinted at forthcoming additions to its own online-transaction capabilities.

GE Interbusiness lets users conduct secure transactions without proprietary software or direct connection to a point of presence (POP) on GE's network. Instead, users access GE's transaction services from any Internet connection using browsers, Telnet, and e-mail. GE says its new offering combines the rigorous security of its pre-existing electronic commerce services with the simplicity of TCP/IP Internet connections that businesses already have in place. "The Internet offers convenience and ease of use," says Anne Biehl, manager of global market development for GE Information Services. She suggests that simple Internet access makes it easier for current GE Information Services customers to "include smaller partners in their online trading community."

In a move that underscores the importance of the emerging online business-to-business marketplace, Jim Manzi, former Lotus Development CEO, has joined Industry.Net *(www.industry.net)* as president and CEO.

Industry.Net has to date focused on creating what chairman Donald Jones calls "an aggregation of buyers and sellers" and on providing information online that allows buyers to make purchasing decisions in a variety of manufacturing markets. The next logical move is into direct online transactions. Industry.Net has been working on our transaction engine for over a year, and the company has pilot programs in place for transmission of purchase orders and request for quotations directly to sellers.

Jones says that soon the company will make a major announcement concerning online funds transfer and transaction clearing that will be accessible via the Internet. Industry.Net also has plans to expand its operations into the international arena.—*Jonathan Karl Matzkin*

MBAs Tackle Web Commerce

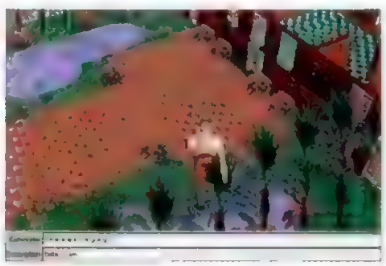
Harvard grad students set up online businesses.

With an eye toward Internet commerce, MBA students at Harvard Business School are learning to develop virtual reality–based businesses in cyberspace. Harvard's MBA program has always been based on the case-study model, where real business challenges are presented. The as-yet-unmastered electronic marketplace now presents a high-profile training ground for the CEOs of tomorrow.

"Historically, breakthrough products like the Internet have been a combination of creative technology and marketing," says associate professor Ray Burke. "The best uses for the Internet are still developing, and this project allows my students to create prototypes to explore the possibilities for their business concepts."

The revenues may be as hypothetical as most commercial revenues on the Internet today, but the business models are real. You can visit them at the AlphaWorld environment at the Worlds Inc. Web site, *(http://www.worlds.net)*, which combines 3D graphics, virtual reality, Internet chat, and multiuser avatar technology. "Colonists" in AlphaWorld have the right to own land and build on it, engage in commerce, explore the environment, and experience its content in a shared virtual-reality space.

The first student teams in the school's "New Product Decision Making" class have built seven businesses in AlphaWorld: Affinity Space (a service to link people with similar interests), Kids Zone (games and entertainment for children), Knowledge Kingdom (an all-ages learning environment), Meet Market (a dating service), New Products Expo (a market research service), Sports World (a fantasy league), and Zoltar's Hidden Lair (a cybermaze game). More prototype businesses are in the works.—*Sebastian Rupley*



CLASS CREDIT: *Harvard Business School students are building virtual-reality businesses within Worlds Inc.'s AlphaWorld.*

PC Magazine Online Events

WWW.PCMAG.COM. Our **InternetUser** site is the first place you should look for the latest information about the Internet, including daily updates, reviews, and examples of the latest browsers, plug-ins, and Internet utilities and development tools. From March 25 to 29 join our **Web discussion** about CD-R drives with contributing editor John Quain.

PC MAGNET. From this online service of ZD Net, available through CompuServe (GO PCMAGNET), you can download *PC Magazine* utilities (GO TIPS) and join in freewheeling discussions about new products in *PC Magazine*'s Editorial forum (GO EDITOR). **First Looks Plus:** From March 25 to 29, discuss Sun Microsystems' Hot Java with reviewer Kevin Reichard. From April 1 to 5, discuss Borland's Delphi 2.0 with Borland's Zack Urlocker and Anders Hejlsberg and contributing technical editor Neil J. Rubenking. **Features Plus:** From March 25 to 29, discuss multimedia authoring tools with reviewers Linda and Erick Von Schweber.—*Tin Albano*

ILLUSTRATION BY ROB WESTERGERG

PIPELINE

By Jake Kirchner

Will We Miss Apple When It's Gone?

Even those of us who watch the computer industry for a living were surprised by how quickly Apple Computer Co. slid into ruin.

Last fall, Apple was one of the leading hardware vendors, with almost 10 percent of the PC market, poised after a rocky year to take advantage of what was expected to be a strong Christmas buying season. It had just spurned an acquisition offer from IBM and was redoubling efforts to compete against Intel-based PCs at the low- and midprice levels.

But in very short order—just a few months, really—a price war in Japan and Apple's inability to meet demand here at home during the holiday rush conspired to leave the company with a $69 million loss for the year-ending quarter. The company announced significant staff layoffs and plans to withdraw from unprofitable markets. With rumors growing of a top-management shakeup, the company's executives opened the year reportedly searching in vain for another company willing to buy Apple.

Events have been moving so rapidly that by the time you read this the company either will be well into serious downsizing under the direction of new CEO, Gil Amelio, or will have closed a merger deal. No matter what happens, the organization we remember as opening the door to the personal-computing age will never again have the stature or the influence of the past.

Should we care?

On the one hand, there's a question of sentimentality that will occupy many chroniclers of Apple's exit from center stage. But I will find it hard to weep for the organization that sold so much hooey to unsophisticated end users, persuading them that an Apple machine was some kind of counterculture icon "for the rest of us." The rest of us evidently comprised anyone who would internalize the marketing mantra that Apple—a Fortune 50 company with industry-leading profitability—was the only computer maker not interested only in money, and that only Apple could produce a machine worthy of the information revolution and its cadres of right-thinking computing enthusiasts.

I'll find it hard to weep for the company that sold so much hooey to end users.

On the other hand, outside the few industry niches that are still Apple strongholds—graphics and desktop publishing in particular—it's doubtful that the great majority of us will feel any effect from Apple's fall from greatness. Its operating system's combination of technical sophistication and ease of use has been matched for the most part by Microsoft's Windows. The next version of the Apple OS has been so long in coming that no one cares any more.

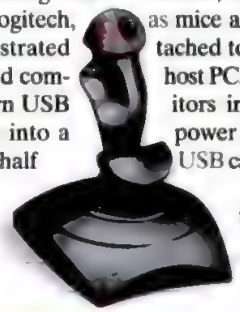
No doubt a bitter group of Macintosh users will feel the sting of Apple's demise. I'm sure there will be a large, forlorn group of Apple users who will struggle along supported only by one another, their online postings becoming increasingly bitter as we close out the millennium.

I won't be counted among their number. But I know that every PC user is better off with a vibrant range of competitors pursuing different approaches to information technology. The industry already is experiencing far too much consolidation and is far too monolithic for its own good. From that standpoint, we indeed will miss Apple when it's gone. And that's reason enough to mourn its passing.

Digital Joysticks, Cool Tunes

Universal Serial Bus peripherals debut.

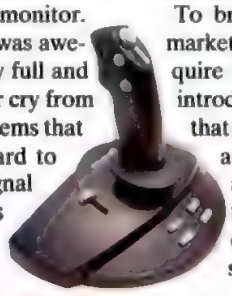
The simplification of the personal computer's I/O architecture through the 12-Mbps Universal Serial Bus made major strides at the USB Developers Conference in February. Numerous companies, including CMD Technology, Intel, Logitech, and Philips demonstrated the first products and components that will turn USB from a specification into a reality in the second half of this year.



LOGITECH: *WingMan Extreme.*

USB, designed to provide a single interface to connect keyboards, mice, and joysticks as well as telecommunications devices such as modems and PBX interfaces, promises not only to simplify PCs, but also to cut the costs of peripherals. By adding a low-speed channel to the USB architecture, unpowered devices such as mice and joysticks can be attached to powered "hubs" (the host PC, for example, and monitors in the future), because power is distributed over the USB cabling itself.

Philips's demonstration of digital audio over USB was the most exciting event at the show. Philips played a digital .WAV file over the USB bus, which was converted to an analog signal externally. It was then transferred to Philips speakers attached to a working model of a USB-ready Philips monitor. The resulting sound was awesome, with incredibly full and rich bass tones—a far cry from today's audio subsystems that rely on the sound card to convert the digital signal to analog. This marks the first working model of a USB transfer of iso-chronous data—a continuous data stream required for data types such as audio and video where timing is a key issue.



MICROSOFT: *SideWinder*

The first USB products that consumers can expect to see on retail shelves will be simple peripherals including mice and joysticks. Logitech demonstrated its WingMan Extreme joystick, and Microsoft showed a fully digital joystick, which uses optical converters that enhance the response times.

To bring USB products to market, peripheral vendors require USB controllers. Intel introduced a USB-controller that supports both 12 Mbps and 1.5 Mbps and enables peripherals and telephony products to communicate with host systems. By the second half of this year, USB host systems should be available as PCs that use Intel's new chip sets come to market.

CMD Technology introduced PCI-to-USB controllers that provide an easy way to plug USB-based hardware into existing systems.—*Carol Venezia*

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First Looks

HANDS-ON REVIEWS OF NEW SHIPPING PRODUCTS

NOTEBOOK PCs

Mobile Triton and Pentium/133 Elevate Notebook Computing

By Brian Nadel and John Morris

Notebook computers have inched one step closer to the Holy Grail of being true desktop replacements with the introduction of systems based on Intel's mobile Triton chip set and its 133-MHz Pentium processor. When combined with generously sized screens, large hard disks, and multimedia features, Pentium/133 notebooks approach the functionality and performance of desktop PCs.

For this miniroundup, we tested the first Pentium/133 notebooks on the market: AST Research's Ascentia P50 and Micron's Millennia TransPort P133. Both sell for about $5,000 fully loaded, weigh about 7 pounds each, and are top-flight performers. They are likely to appeal both to those looking for a portable computer with staying power as applications demand ever more processing power and to traveling executives who want the muscle and multimedia capabilities of a high-end desktop PC.

THE NEED FOR SPEED

In addition to pushing the clock speed of the CPU to new heights, the Pentium/133 also boosts performance by using the broader bandwidth of a 66-MHz motherboard. The result is about a 30 percent improvement in all-around performance that goes beyond the 11 percent speed difference between Pentium/120 and Pentium/133 processors.

The notebook version of the Pentium/133 delivers these performance gains while providing at least 2 hours of battery life, thanks to the chip's energy-efficient architecture. The processor is manufactured with Intel's 0.35-micron process and wrapped in film-thin Tape Carrier Packaging, which is then attached directly to the motherboard. This mobile Pentium/133 uses dual-voltage technology: The computational core operates at a miserly 2.9 volts (2.9V) while running externally at the standard 3.3V. All told, the processor draws just

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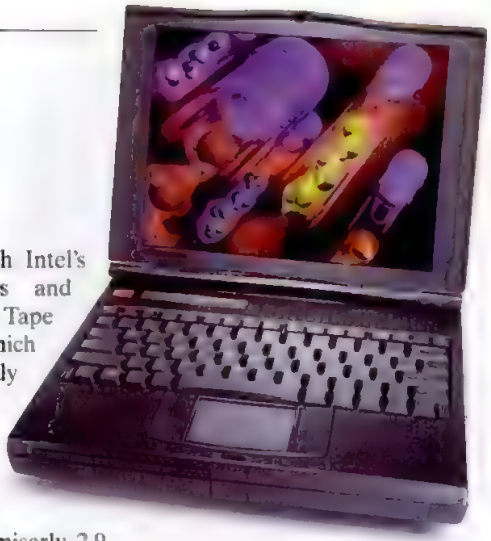

PROCESSING POWERHOUSE: *The AST Ascentia P50's CPUmark processor test scores are the highest we've seen from a notebook.*

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PROGRAMMING

Delphi 2.0: 32-Bit Programming And Database Power

By Neil J. Rubenking

In the year since its initial release, Borland's programming environment, Delphi, has enjoyed immense success and received numerous awards, including *PC Magazine*'s Technical Excellence award (First Looks, May 16, 1995). Delphi 2.0 keeps the momentum going by adding a 32-bit optimizing compiler, Windows 95 and Windows NT support, and enhancements for database, client/server, and team programming features.

Delphi 2.0 is a 32-bit environment that produces 32-bit programs that run only under Windows 95 or Windows NT. The package also includes the Delphi 1.0 compiler so that developers can continue to support 16-bit Windows applications.

DESKTOP TO PROGRAMMER

Borland offers three versions of Delphi 2.0, each aimed at a different audience. Individual programmers will be satisfied with the $499.95 Delphi Desktop 2.0 package, which includes the 32-bit compiler and development environment along with a host of standard components.

Delphi Desktop 2.0 has Windows 95–specific user-interface components, an Object Repository for storing standard forms and projects, and a Database Explorer tool for visual database design. Full OLE support is built-in, including OLE automation (both

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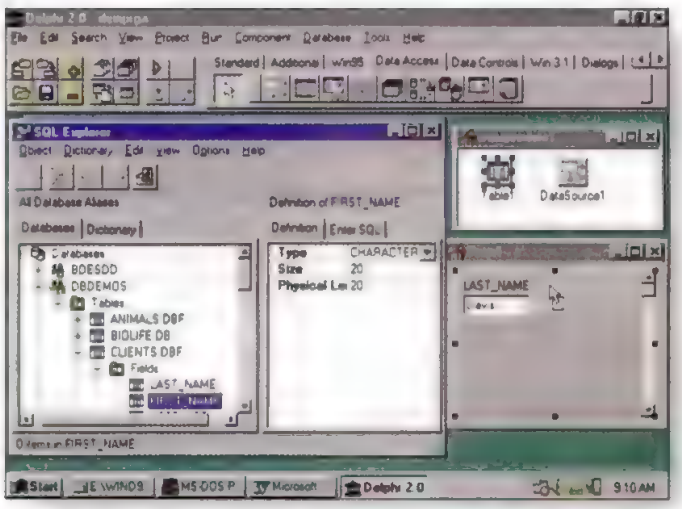


WHAT'S WHERE?: *Delphi 2.0's Database Explorer provides an overview of available databases and tables. These elements can be dragged directly onto forms.*

PHOTOGRAPHY BY THOM O'CONNOR; SCREEN IMAGE BY ROB MAGIERA

P/133 Notebooks

Continued from page 39

3.3 watts of power at peak usage.

The final piece of the portable puzzle is Intel's mobile Triton chip set, also known as 430MX. This PCI-based core-logic chip set streamlines operations and supports sophisticated power-conservation measures.

PENTIUM/133 REDUX?

Our last major roundup of notebooks ("On the Road with the Pentium," January 23, 1996) contained a trio of Pentium/133 notebooks. Each, however, used a traditional 3.3V desktop processor. As a result, battery life and performance of the ACW SoundPad IIIB and the FutureMate 5413T and FutureMate 5513D twins were disappointing; we report the benchmark test results of the FutureMate 5413T alongside those of the Ascentia P50 and TransPort P133 for comparison.

With all these units have going for them and with other manufacturers expected to follow with equally exciting notebooks in the near future, the hardest part may be deciding which notebook is right for you.

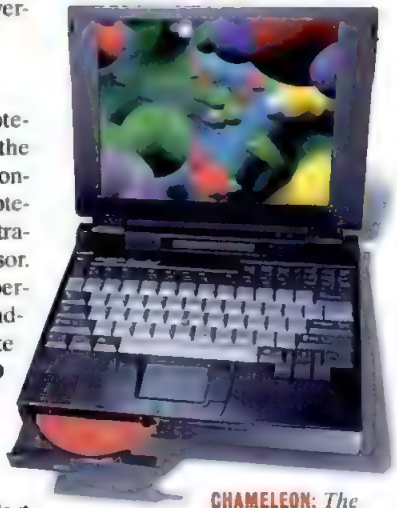
AST ASCENTIA P50

AST Research has built a dual personality into its $5,098 Ascentia P50. As a result, it is just as comfortable being a powerful notebook for traveling executives as it is being a desktop replacement system.

AST started with all the necessary ingredients: a Pentium/133 processor, 256K of external cache, an 11.3-inch active-matrix screen, a 4X CD-ROM drive, an 800MB hard disk, and lithium ion batteries. To that, it added multimedia features, a touch pad, and even a joystick/MIDI port. The case includes an RJ-11 telephone connector for an optional 28.8-Kbps internal data/fax modem that AST says will be available soon; for now, a PC Card modem will suffice.

The Ascentia P50 measures 2.3 by 11.3 by 8.9 inches and weighs 7 pounds 2 ounces. It has a travel weight of 7 pounds 14 ounces with the AC adapter, which measures just 1.3 by 2.3 by 4.5 inches.

We tested an Ascentia P50 that was based on Intel's mobile Triton chip set and had 16MB of EDO memory. For audio, the Ascentia P50 uses the 16-bit Sound Blaster Vibra circuitry; there is a pair of stereo speakers and a microphone in the palm rest. One of the strong points of the Ascentia P50 is its bright, 11.3-inch Super VGA screen, which is capable of displaying 64,000 colors at 800- by 600-pixel resolution.



CHAMELEON: *The Micron Millennia TransPort P133's dual drive bays can accommodate a startling variety of peripherals.*

The rear panel of the Ascentia P50 has the standard complement of connectors: serial and parallel ports, an external mouse/keyboard port, a VGA connector, and a slot for connecting a port replicator. There's also a microphone audio jack, as well as an IrDA port for wireless communications. The Ascentia P50 can accommodate two Type II PC Cards or one Type II and one Type III card.

The Ascentia P50 is one of the first notebooks to incorporate the Windows 95–specific keys. In addition, the convenient touch pad allows you to drag the pointer or cursor to the desired location and then tap the surface to activate the location, although it took a while for us to get used to this feature.

Although it posted stellar scores across the board, the Ascentia P50's score of 54 on our Winstone 96 tests was tied by the TransPort P133. On our CPUmark processor tests, the Ascentia P50 barely beat the TransPort P133, with scores of 257 and 259 on 16- and 32-bit tasks, respectively.

On our WinDrain battery test, which measures battery life with power conservation disabled, the Ascentia P50's lithium ion battery lasted 2 hours 34 minutes, half an hour longer than that of the TransPort P133. If you're willing to sacrifice the CD-ROM and floppy disk drive, you can install a second, smaller lithium ion battery pack that contains 8 cells, rather than the 12 that are in the primary battery.

With its excellent performance and well-rounded personality, the Ascentia P50 is an attractive alternative to a desktop PC in the office, on the road, and even at home.—*JM*

AST Ascentia P50. List price: With Pentium/133 CPU, 16MB RAM, 256K external cache, 800MB hard disk, 11.3-inch active-matrix display, $5,098. AST Research Inc., Irvine, CA; 800-876-4278, 714-727-4141; http://www.ast.com. *Circle 428 on reader service card.*

MICRON MILLENNIA TRANSPORT P133

Micron, a company that has garnered several Editors' Choice awards for desktop PCs, has branched out into notebooks. By all accounts, the $5,498 TransPort P133 is nearly a dead ringer for IBM's ThinkPad 760CD (First Looks, November 21, 1995) but performs better and saves you about $2,500.

The TransPort P133, which is manufactured by Sanyo, includes all you're likely to need on the road: Pentium/133 performance, a 1.3GB hard disk, lithium ion batteries, a 4X CD-ROM, infrared communications, Sound Blaster audio, and an 11.3-inch active-matrix display capable of 800- by 600-pixel resolution and 64,000 colors. With a travel weight of 7 pounds 2 ounces and dimensions of 11.0 by 8.5 by 2.3 inches, the TransPort P133 is roughly the same size as and a little lighter than the ThinkPad 760CD, which has a 12.1-inch screen.

On the left side of the TransPort P133, you'll find space for a pair of Type II PC Cards or a single Type III card. The right side contains a modular bay for either the system's floppy disk drive or a battery. In the front, the CD-ROM module can be swapped for a battery, the floppy disk drive, or a second hard disk, raising internal data storage to more than 2.5GB.

Depending on what's installed, this modularity results in seven

BENCHMARK TESTS

Pentium/133 Notebooks

The AST Ascentia P50 and the Micron Millennia TransPort P133 each outperformed the average Pentium/120 notebook and the FutureMate 5413T, which has a Pentium/133 desktop processor.

To measure the performance of these systems, we used ZD Winstone 96, Version 1.0, and ZD WinBench 96, Version 1.0. We used ZD WinDrain to measure battery life. Each notebook was equipped with 16MB of RAM and ran Windows 95.

Higher numbers represent better performance. Red type denotes first place.	ZD Winstone 96	ZD Graphics WinMark 96 (Mpixels/sec)	ZD Disk WinMark 96	ZD CPUmark16	ZD CPUmark32	ZD CD-ROM WinMark 96	ZD WinDrain (hours minutes)
AST Ascentia P50	54	12.2	673	257	259	365	2:34
FutureMate 5413T (Jan. 23, 1996)	44	9.7	569	194	182	235	0:55
Micron Millennia TransPort P133	54	12.3	781	250	259	364	2:04
Average Pentium/120 notebook (Jan. 23, 1996)	42	9.4	589	179	169	211	1:28

distinct computing personalities, ranging from two hard disks for information-safe mirrored data to a setup with CD-ROM and battery installed for multimedia programming on the road or a double-battery notebook for the long haul.

There are two penalties, though, because the floppy disk drive is not hot-swappable, and you can't have both the CD-ROM and the floppy disk drive installed and run the system on battery power. To have it all, you'll need to have access to an electrical outlet.

While the Ascentia P50 provides a touch pad, the TransPort P133 offers the flexibility of either a similar touch pad or a keyboard-mounted pointing stick. Unfortunately, you can't have both activated at once. On the other hand, the Ascentia P50's keyboard includes the three Windows 95–specific keys, whereas the TransPort P133's doesn't.

Three unexpected extras stand out. First, the TransPort P133 has a pair of IrDA infrared transmission ports, one in the back and one in the front. Also, at 0.9 by 4.4 by 2.2 inches and 8 ounces, the TransPort P133's power adapter is among the smallest and lightest around. Finally, there are ports for both an external keyboard and a mouse.

TOP-FLIGHT PERFORMANCE

Based on Intel's mobile Triton chip set, the TransPort P133 comes with 256K of external cache and 16MB of EDO memory. Its performance set a new standard for notebook computing with top scores on our Winstone 96 (54), Graphics WinMark 96 (12.3 million pixels per second), and Disk WinMark 96 (781) tests. The system's 16-bit and 32-bit CPUmark processor test results were slightly behind those of the Ascentia P50.

With power conservation disabled, the TransPort P133 lasted 2 hours 4 minutes on our WinDrain battery test. But with the TransPort P133's flexible power management in place, the system lasted quite a bit longer. If you put the system into suspend mode, it'll take a little experience to remember that the tiny resume button, which has a coffee-cup logo, is above the right-side drive bay.

The TransPort P133 has an optional multimedia Port Replicator that includes a pair of speakers and an Ethernet adapter as well as a power adapter for changing the unit's batteries and a variety of audio and video connectors. At $299, it's a bargain for those who split their time between the office and the road.

If you are turned off by the price of full-featured notebooks, the Micron Millennia TransPort P133 will seem like a breath of fresh air, as long as you don't venture far from an electrical outlet.—*BN*

Micron Millennia TransPort P133. List price: With Pentium/133 CPU, 256K external cache, 16MB RAM, 11.3-inch active-matrix screen, 4X CD-ROM, extra battery, extra hard disk, $5,498. Micron Electronics Inc., Nampa, ID; 800-388-6334; http://www.mei.micron.com. *Circle 429 on reader service card.*

PC CARD MODEMS

Angia's SafeSend: The Notebook Modem That Works Anywhere

By Earle Robinson

Angia Communications' PC Card modem, SafeSend, is the ideal communications solution for the frequent traveler who has ever wanted to connect to a digital phone connection. The $399 SafeSend works with virtually any phone system—analog or digital—regardless of whether it's located in a hotel, airport, or satellite office.

ANALOG OR DIGITAL

Weighing just 1.9 ounces, the 1.8- by 2.8- by 0.6-inch Type II card is different from the plethora of other PC Card modems available because it comes with a pair of adapters: one for standard analog phone lines and another for plugging directly into a digital telephone.

With an ordinary analog connection, you use SafeSend just like any other PC Card modem. Plug the phone into the adapter and then connect the adapter to the RJ-11 socket in the wall, and you're ready to go.

To connect to a digital phone system, first you'll need to remove the handset's phone plug and insert it into the modem's four-wire RJ-11 adapter. The next step is to find the right protocol for the phone system. That's accomplished by either trying each of the four communications settings individually until a connection is made or by choosing the setting that corresponds to the phone system that you're using—if you know what type of phone it is. Circuitry in the modem protects it from digital current surges.

ANY PHONE, ANYWHERE: *Angia's PC Card modem, SafeSend, connects to a variety of digital telephones with an adapter (inset).*

When connected, the V.34 SafeSend allows the phone to work normally for voice calls. When you wish to dial into an online service or to your network's computer, most of the time you'll be able to do so automatically with your communications program. Occasionally this won't work, so you may have to dial the service manually and then switch to your communications program.

SafeSend is better than other digital-phone PC Card modems that rely on an optional digital adapter, because the SafeSend digital PBX adapter doesn't require an external power supply or batteries. Technical support is provided through a toll-free number and via Angia's World Wide Web site (*http://www.angia.com*). SafeSend uses an AT&T chip set, which allows updating of the modem's internal code. In addition, a capable but rudimentary fax and communications program, QuickLinkII, is included.

FLEXIBLE PHONES

SafeSend worked well on tests over a wide variety of phone systems in Europe, Mexico, and the United States. In every case, we got a clear connection regardless of which system we used. According to Angia, SafeSend is compatible with more than three dozen digital PBX designs, from AT&T's to Vodavi's.

For the traveler who doesn't know whether the next destination will have an analog or digital phone connection, we recommend SafeSend as the most convenient and versatile PC Card modem available today.

SafeSend. List price: $399. Requires: 4MB RAM, 5MB hard disk space, Microsoft Windows 3.1 or later, Windows 95, or Windows NT. Angia Communications, Provo, UT; 800-877-9159, 801-371-0488; http://www.angia.com. *Circle 427 on reader service card.*

Delphi 2.0

Continued from page 39

as a client and a server), automatic installation of .OCX controls, OLE container objects with in-place activation, network OLE, and Visual Basic 4.0–style remote automation.

NEXT STEP UP

The next step up is the $799.95 Delphi Developer 2.0, which adds additional database features, including low-level support for Borland Database Engine functions, a single-user local InterBase server license, and ODBC support. It also includes the source code for Delphi 2.0's Visual Component Library and a utility for creating installation programs. Although Delphi Developer 2.0 includes an interface for Intersolv's PVCS version-control system, you'll have to purchase the program separately.

At the high end, the $1,999.95 Delphi Client/Server Suite 2.0 is aimed at professional client/server development teams. Team and network development are emphasized here with Intersolv's PVCS version-control system.

The SQL Database Explorer allows visual database programming using server-based data, and the SQL Monitor aids in performance tuning. The new Data Pump Expert provides enough handholding to ease scaling from local to client/server database programs.

Almost all Delphi 1.0 programs will compile unchanged under Delphi 2.0. There's an instant boost in speed based on using 32-bit instructions running on a 32-bit CPU and on the compiler optimizing the generated code to reduce size and increase speed.

Unlike C++ compilers, which offer a host of optimization choices, Delphi 2.0 sticks to optimizations that are appropriate for the program.

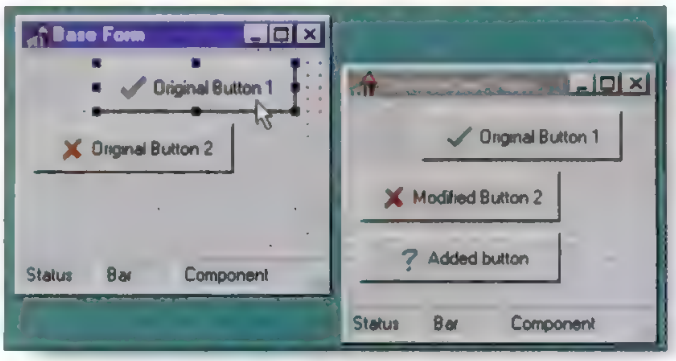
The move to 32-bit operations has a positive effect on data. For one, the 64K limit on the size of an individual data structure disappears. For another, the new data type, called AnsiString, combines the best features of the old Pascal-style length-byte String and the C-style null-terminated string along with virtually unlimited length.

Delphi 2.0 has gotten smarter as well. Instead of halting immediately on finding a syntax error, the compiler now reports multiple errors at once. In addition, the compiler warns about code that may be syntactically correct but logically suspect. For example, it points out wasteful code elements such as variables that are declared but never used.

The Delphi 2.0 compiler can generate and use standard .OBJ files, which are used in multilanguage projects. It's capable of generating applications that take advantage of the enhanced multitasking in Windows 95 and Windows NT. And its built-in 32-bit optimizing linker caches units whose source code hasn't changed.

To build a Delphi program, you place component objects on a form object, assign values to their properties, and write code to handle events such as mouse-clicks and keystrokes. Delphi 1.0 made creation of descendant *component* objects quite simple but provided no means to use true descendants of the essential form object.

Delphi 2.0's Visual Inheritance more than remedies this. A Delphi 2.0 program can create a new form based on an existing form within the project or in the Object Repository. The new form is a true descendant, so enhancements made to the original are carried over into the descendant form.



VISUAL INHERITANCE IN ACTION: *Moving a button on the base form causes the corresponding button to move in the descendant form.*

Delphi 2.0's Data Module is a new type of form that is not visible at runtime. It can aid database programmers by storing nonvisual components such as table and query objects. A Data Module stored in the Object Repository can encapsulate standard databases and business rules.

Delphi 2.0's Database Explorer displays a hierarchical chart of fields, databases, and tables, giving you a bird's-eye view of the structure or content. Drag a table from the Database Explorer to a Data Module, and a corresponding table object is automatically created. Drag a field from the Database Explorer to a form, and an appropriate data-aware component appears.

In Delphi 1.0, the popular data-aware grid component was an instant row-and-column view for any table. In Delphi 2.0, it gains the ability to perform code-free lookups in specified columns, pulling the list of available values from another table or from a hard-coded list. The Columns Editor also provides substantial control over the formatting of grid columns and titles.

The new Multi Object Grid in Delphi 2.0 provides a happy medium between the data-aware grid that can display one record per row and a view full of data-aware components that can show one record per screen.

ADDING A WINDOWS 95 LOOK

Whether your programs run under Windows 95 or Windows NT, they can make use of the Windows 95 user-interface components. These include the HeaderControl, ImageList, ListView, StatusBar, and TreeView components that make up the main window of the Windows 95 Explorer, as well as the TabControl and PageControl used in property dialog boxes.

The RichEdit component in Delphi 2.0 is a text editor with full formatting support and virtually unlimited capacity. The UpDown component can be used alone or can be attached to any edit-control element to "spin" automatically a numeric value up and down within a defined range.

In addition, the TrackBar component is a sliding bar that allows visual adjustment of a continuous value. Programs can use the ProgressBar to display the progress of an ongoing procedure. Finally, the HotKey component allows the user to input a key combination by pressing the desired keys.

Current Delphi users can upgrade to Delphi 2.0 for its 32-bit features without abandoning existing 16-bit code. Delphi 2.0 offers all the benefits of Visual Basic 4.0—including OLE support and remote automation—without Visual Basic 4.0's limitations. And it produces speedy, fully compiled programs that stand alone without reliance on a runtime interpreter.

For 32-bit visual programming, Delphi 2.0 is a hot choice.

Delphi Desktop 2.0. List price: $499.95. **Delphi Developer 2.0.** List price: $799.95. **Delphi Client/Server Suite 2.0.** List price: $1,999.95. Requires: 8MB RAM, Microsoft Windows 95 or Windows NT 3.51, 20MB hard disk space (minimum Delphi Desktop 2.0 installation), CD-ROM drive. Borland International Inc., Scotts Valley, CA; 800-233-2444, ext. 1350; 408-431-1000; fax, 800-408-0001. *Circle 426 on reader service card.*

FIRST LOOKS PLUS

From April 1 to 5, go online to discuss Borland's Delphi 2.0 with Zack Urlocker and Anders Hejlsberg of Borland and Neil J. Rubenking, the contributing technical editor of *PC Magazine*. Type GO EDITOR on CompuServe.

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CIRCLE 235 ON READER SERVICE CARD

REMOVABLE DATA STORAGE

Iomega's Jaz Delivers Near-Hard Disk Speed For the Price of Optical Media

By Alfred Poor

Iomega Corp. has finally begun shipping the Jaz Drive, its innovative removable hard disk system. Except for packaging considerations, the Jaz seems to have been worth the wait. This drive features shirt-pocket-size cartridges that can hold 1GB of data, but so far it's available only in internal configurations.

Micron Electronics was one of the first PC companies to include the Jaz Drive in its high-end systems; expect other vendors to follow in the near future. By the time this review appears in print, Iomega hopes to be shipping the external version of the drive, which was designed to be an add-on peripheral.

COPYCAT: *The Jaz Drive's copy utility makes it easy to back up data from one disk to another or to make copies of a cartridge.*

Identical except for packaging, the internal and external drives move data across a Fast SCSI-2 interface. The Jaz cartridge itself is a hybrid design that uses two platters of a special magnetic media stored in a hard plastic container. At a bit less than 4 inches square and less than half an inch thick, the cartridge is marginally bigger but much thicker than a standard floppy disk.

THE BIG EASY

We tested the Jaz Drive with the $99 1GB cartridge on a Pentium/75 PC test-bed. Installation of the Jaz Drive was fairly easy and took about 10 minutes. The Jaz internal drive that we tested does not require a terminator, because the Iomega SCSI card comes with a special ribbon cable that includes a terminator at the end.

Software installation consisted of running a program from a floppy disk and then using an included cartridge that contains a variety of utility programs. You can unlock this cartridge so that you can use it to store your own data as well.

In addition to a basic configuration program, the Jaz system comes with Copy Machine, a program that makes it simple to copy either the contents of one cartridge to another using a single drive or the contents of any other drive on the system to a Jaz cartridge. Users in a hurry will find this is a quick and easy way to mirror a drive or copy an entire drive.

HARD DISK SPEED, ALMOST

Because the Jaz disk spins at 5,400 rpm, the drive's specifications come close to those of a system's native hard disk. This translates into a 12-millisecond average seek time, an average sustained data-transfer rate of 5.5 megabytes per second (MBps), and a burst data throughput of 10 MBps. In addition, the drive comes with a 256-kilobyte (256K) on-disk buffer to speed performance.

In our evaluation test system, the Jaz posted a score of 415 kilobytes per second (KBps) on our Disk WinMark 96 benchmark tests, a result that lagged behind the 606-KBps data throughput for the system's Western Digital Caviar 2700 hard disk.

For sequential reads of 2K and 4K data, the Jaz was faster than the system's hard disk by about 10 percent.

HANDFUL OF DATA: *Iomega's Jaz cartridges can hold up to 1GB of data.*

The Jaz system has been designed for the long haul. According to Iomega's specifications, the drive has been designed to survive a 3-foot drop, up to a 3g shock while running, and up to 80g while not running; the cartridges come with a lifetime warranty. Road warriors will be comforted to know that the cartridges have been designed to work at altitudes up to 10,000 feet, which should be fine in a pressurized airline cabin—or on a mountaintop, for that matter.

In addition, you can use all the standard DOS disk utilities on the Jaz cartridges. The Jaz cartridges come preformatted as a single DOS partition, meaning that they use 16K per cluster, which can be wasteful if you intend to fill a cartridge with many small files.

We suggest that you use DOS's FDISK or Power Quest's PartitionMagic (First Looks, August 1995) to partition the cartridge into multiple drives with smaller clusters for greater efficiency. This means that you can set a cartridge up to have the same-size partitions as the hard disk on your system, making it easy to back up complete drives in an efficient manner.

FAST AND CHEAP

At $99, the 1GB cartridge currently is not as inexpensive as various optical-disk removable read/write/erase products, but the Jaz has a significant performance advantage over these less expensive media devices. And at 10 cents per megabyte, the Jaz is much cheaper than even the least expensive hard disks.

Almost as fast as a hard disk yet priced competitively with the new high-capacity optical-media devices, the Iomega Jaz Drive is an attractive bargain for PC data backup as well as online storage of archival data. Now that it's finally shipping, the Jaz looks as if it could be a big hit.

Iomega Jaz Drive. Estimated street price: $599. Requires: PC with SCSI host or open ISA slot. Iomega Corp., Roy, UT; 800-697-8833, 801-778-1000. *Circle 403 on reader service card.*

BENCHMARK TESTS

Iomega Jaz Drive

PC MAGAZINE LABS

The Jaz Drive, which uses 1GB removable data cartridges, was off the pace of our test PC's Western Digital Caviar 2700 hard disk by over 30 percent on the ZD Disk WinMark 96 benchmark test suite. In other areas, such as sequential reads and writes, the Jaz surpassed the hard disk's performance.

We used a Pentium/75 PC with 8MB of RAM and Windows 95 to compare the Iomega Jaz Drive with the system's internal hard disk.

ZD Disk WinMark 96

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COLOR SCANNERS

Umax's Tabloid Scanner: Better For Paper Originals than for Film

By Daniel Grotta and Sally Wiener Grotta

Scanning large originals on a standard flatbed scanner can be a tedious job that requires carefully stitching two or more separate images together into a single file. Umax's $6,995 color flatbed scanner, the Mirage D-16L, works with up to 12- by 17-inch originals to create outstanding scans of paper originals.

TWO EYES, ONE SCANNER

What sets the single-pass Mirage apart is its dual-lens optical system. The first lens scans the outer two-thirds of the original at optical resolutions of up to 400 by 800 dots per inch (dpi). The second lens scans the center 6- by 17-inch region at up to 800 by 1,600 dpi.

The Mirage's MagicScan interface displays the image with dotted red lines to show each scan region. Since the user-adjustable cropping lines are also red, it's easy to confuse them with the scan regions. When the selected scanning frame is larger than the 6-inch-wide center swath of high resolution, the Mirage automatically switches from the single to the dual lens and adjusts the resolution. Alternatively, the user may manually select a single- or dual-lens scan.

A positive by-product of the Mirage's dual-lens system is the scanner's interpolated resolution. The smaller the original, the greater the resolution: 1,600 dpi for 11- by 17-inch originals and 9,600 dpi for 35-millimeter (mm) transparencies. The price one pays for this extra resolution is file size. At its maximum, the scanner can create an enormous 23.9GB file.

The Mirage has an impressive specification sheet: It's a single-pass, 30-bit device with a dynamic range of 3.2. That's less than a typical service-bureau scanner's dynamic range of 3.5 or higher but superior to the 3.0 dynamic range of most desktop flatbed scanners.

For even better contrast and brightness control, the intensity of the Mirage's four-bulb illumination system, which uses cold cathode tubes instead of the standard fluorescent bulbs, can be adjusted through software. In addition to black-and-white, 256-level-gray-scale, and RGB color scans, the Mirage also produces CMYK color images for direct prepress work.

Instead of requiring you to position a transparency or negative carefully in the corner of the bed to produce a straight scan, the Mirage includes film frames that control the scan area. Slip the film into one of the provided plastic frames (which range in size from 35 mm to 4 by 5 inches), place them on the scan bed, and the Mirage automatically scans only those areas. We found that we could scan up to 32 35-mm frames in one pass.

TABLOID GOES DIGITAL: *Umax's Mirage D-16L can turn 12- by 17-inch originals into 30-bit color images.*

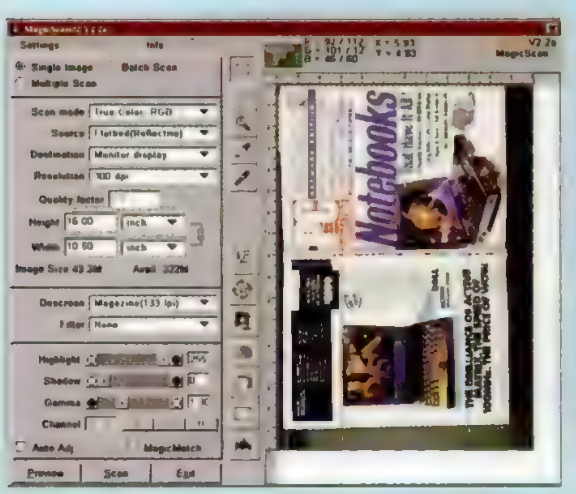
ODD FRAMES

On the downside, the 2- by 2-inch frames don't fit many standard film mounts. Also, the single frames are designed for unmounted film; we got around this restriction by carefully laying the frame on top of the mounted slide.

The unit ships with Umax's color-calibration software, called MagicMatch, which includes test targets and profiles for popular printers, monitors, and image setters. Although there's no sheet feeder available, Umax's MagicScan software has the ability to perform multiple scans as well as set up a queue that automatically saves and names files. The Mirage comes with controls for resolution and color depth; cropping, sizing, rotating, and flipping; sharpening and unsharpening; and creating negative or positive scans, as well as those for gamma-curve adjustments.

The Twain software is 32-bit

Side-by-Side Scans



ZOOM IN: *The MagicScan interface (left) provides a multitude of adjustments, including a descreening option. Using the 133-line-per-inch setting, the descreened scan sample (above, left) is fuzzier and has less detail than the raw image (above, right).*

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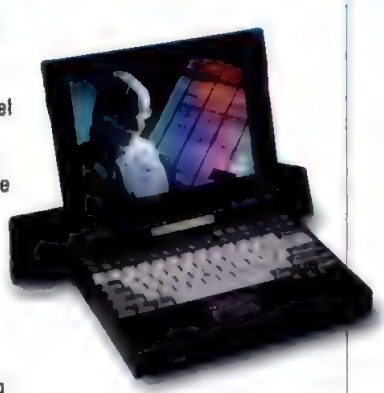

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- 1.2GB removable hard drive
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$4,899 Business lease $167/month

Micron Millennia TransPort P120
- Intel 120MHz Pentium processor
- 11.3" active matrix color display, 800 x 600
- 16MB EDO memory (48MB max.)
- 1.2GB removable hard drive

$4,499 Business lease $153/month

- Intel 120MHz Pentium processor
- 11.3" dual scan color display, 800 x 600
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intel inside pentium

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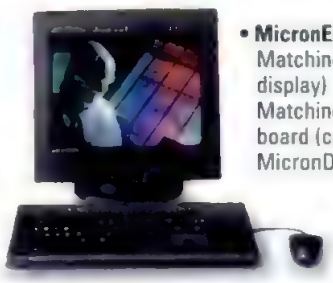
- **MicronDock™ multimedia port replicator** Ethernet LAN adapter, SCSI-2 port, S-Video and NTSC video outputs, built-in stereo speakers, infrared port, headphone, microphone, line-in jacks, parallel, serial, VGA and 2 PS/2 ports.....**$299**



- **MicronExec™ desktop package** Matching black 17" monitor (15.8" display) Matching black mouse and keyboard (can be used with or without MicronDock).....**$799**

- Motorola Montana 28.8 fax/modem supports regular telephone connections, cellular phones and two-way paging devices.....**$299**
- 2nd intelligent modular lithium-ion battery.....**$199**
- 2nd 1.2GB modular hard drive (2.6GB total).....**$599**
- 16MB EDO memory upgrade.....**$699**
- Leather carrying case upgrade.....**$ 59**

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TRNS-PCMG-9604

and includes several descreening settings to scan halftone material without moire patterns and other artifacts. Although MagicScan includes specific settings, such as 85 lines per inch (lpi) for newsprint and 133 lpi for magazines, there's no provision for custom resolutions.

MagicScan auto-installs into Windows 3.x or Windows 95 environments. Because of the Mirage's 2MB data buffer and Fast SCSI throughput, prescans and scans were fast. Using our 100-MHz Pentium test-bed, which was equipped with 64MB of RAM, we scanned two magazine pages at 300 dpi and 30-bit color, creating a 43.8MB file in 77 seconds. A 35-mm transparency scanned at 2,400 dpi took 96 seconds.

UP CLOSE

We were quite impressed with the all-around quality of the reflective scans at all resolutions. When we magnified a small part of the page at 9,600 dpi, we were able to examine the halftone color rosettes and even see the paper's fiber and grain. On the other hand, scanning transmissible material was a disappointment; we were unable to get a sharp, well-lit scan of a 35-mm slide no matter what we did.

The Mirage includes a transparency cover, a generic 16-bit SCSI board, a cable and terminator, PC and Macintosh drivers, and various film masks. To that, Umax adds Photoshop 3.0, Pixar Tapestry, WordLinx OCR, and a feature-limited version of Kai's Power Tools 2.0.

Though it is similar to the $9,995 dual-lens Linotype Hell Opal scanner, the Mirage D-16L goes a step further by being able to scan up to 12- by 17-inch transparencies or negatives, compared with the Opal's 8- by 10-inch maximum. All told, the Mirage provides service-bureau capabilities at a desktop price.

Mirage D-16L. List price: $6,995. Requires: 2MB RAM, free ISA slot, Microsoft Windows 3.1 or later. Umax Technologies Inc., Fremont, CA; 800-562-0311, 510-651-9488; fax, 510-651-8834. *Circle 406 on reader service card.*

WORKGROUP CONTACT MANAGERS

GoldMine Enhances Connectivity and Speed In the Windows 95 World

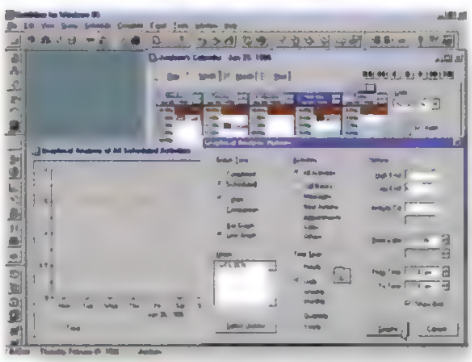
By J.W. Olsen

GoldMine Software Corp., formerly called Elan Software, builds on the strengths that earned GoldMine an Editors' Choice award in our August 1995 roundup of workgroup contact managers ("Sharing the Wealth") and brings this program into the Windows 95 world. With the $295 ($895 for five-user network) GoldMine for Windows 95, the company offers a strong if not quite complete exploitation of Windows 95 features, with new support for the Internet and pagers, as well as a notable increase in speed.

GoldMine continues to accept a staggering array of details into your databases, yet keeps everything at your fingertips through a well-designed tabbed interface. A healthy variety of predesigned reports help keep a handle on the details, while statistical, graph, and forecasting tools reveal how the details fit together.

SPREAD THE DATA WEALTH

Coping with voluminous contacts in a workgroup setting is often the collective responsibility of the group. GoldMine spreads the work by dividing contacts among employees in your enterprise.

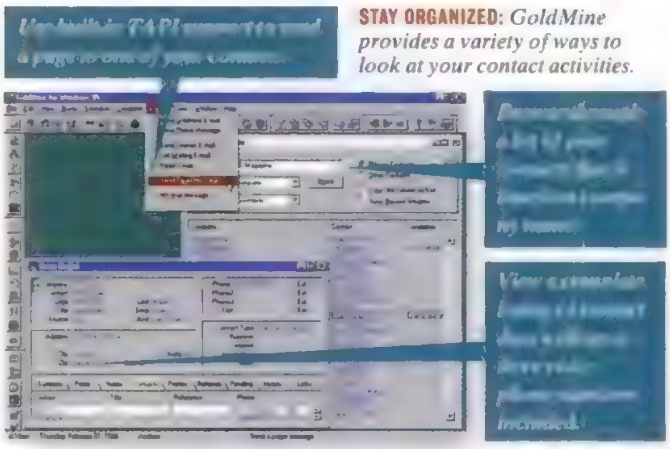


UPS AND DOWNS: *GoldMine lets you graph your day's schedule so you can see how busy you'll be.*

These days, you must reach these contacts through a diverse array of communications media, such as phone, fax, e-mail, and wireless pager. GoldMine coordinates most of these functions from one pull-down menu.

Besides exploiting the Internet for e-mail, GoldMine now lets you fully synchronize databases with another GoldMine user. The company's separate 16-bit GoldSync, which costs $495 per server, continues to augment the basic intrinsic synchronization capabilities for Windows 3.x. The big change is that this synchronization program now works with GoldMine for Windows 95. GoldMine Software hasn't announced a 32-bit GoldSync that would run natively in Windows 95, but you should expect to see one as early as the fall.

GoldMine makes strides in exploiting Windows 95 capabilities in this release. Wizards ease you through a few of the more complex and onerous procedures in the program, such as importing the contents of a foreign database. Relying solely on the database wizard, we matched appropriate fields in a 1,100-record dBASE database with a GoldMine database and then imported and indexed the data, all in five minutes. Subsequent searches, on-the-fly indexing, graphing, and database analyses all were exceptionally fast compared with both the 16-bit GoldMine and other database-oriented software.



STAY ORGANIZED: *GoldMine provides a variety of ways to look at your contact activities.*

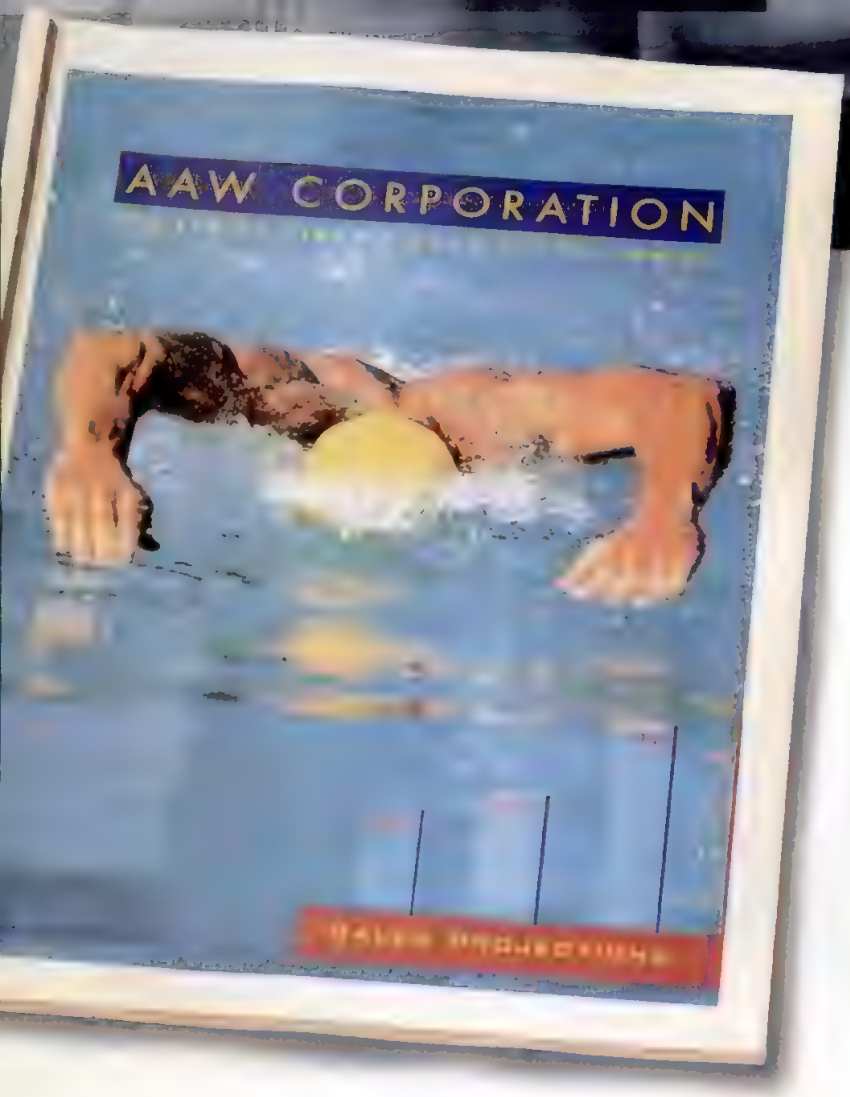
DDE, YES. . .OLE, NO

GoldMine supports Windows 95's TAPI, and it can launch and link DDE-capable products. GoldMine doesn't provide necessary OLE support, which means that GoldMine Software's announced plans to support Microsoft's Schedule+ will have to wait for a future release. For now, you must rely on the included GoldAlarm. This external program continuously scans for GoldMine alarms when GoldMine isn't running and then loads GoldMine upon request.

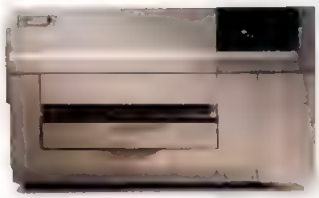
GoldMine for Windows 95 is the first Windows 95 workgroup contact manager that doesn't skimp in terms of functionality or performance.

GoldMine for Windows 95. List price: $295. Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 95. GoldMine Software Corp., Pacific Palisades, CA; 800-654-3526, 310-454-6800; fax, 310-454-4848. *Circle 425 on reader service card.*

In the past, winning new business was a black or white proposition.



Introducing the future.
The HP Color LaserJet 5.



First impressions are important, but business is often won or lost based on last impressions. So why shouldn't your proposals be as impactful and persuasive as possible? With the new HP Color LaserJet 5 printer, they can. Dramatic improvements in technology allow the Color LaserJet 5 to create 1200 dpi equivalent image quality, literally producing millions of permanent solid colors. The Color LaserJet 5 is compatible with all popular software and is fully networkable. Best of all, with its remarkably low cost of ownership, you'll be amazed at how little it costs to add color to your documents. Call 1-800-LASERJET Ext. 1443 for some thoroughly convincing print samples. So you can start claiming business victories today.

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INTERNET PROGRAMMING

Java 1.0: Something New Is Brewing on the Web

By Kevin Reichard

Java 1.0, from Sun Microsystems, enables developers to write miniapplications that are distributed over the Internet and work across a range of browsers, and it provides an early glimpse of the potential for this much-touted programming language. But Java 1.0, available from Sun's World Wide Web site (*http://java.sun.com*), still lacks some basic tools and is to a real programming language and development environment as cafeteria coffee is to Italian espresso.

Java 1.0 consists of an interpreter, a debugger, a tool for creating C-header and stub files from a Java class, a documentation generator, a compiler, and a viewer for running applets without a Web browser. The essence of Java is its ability to create small, focused applets, which are embedded in a Web page using a simple HTML tag and then transferred from a Web server to a Web browser. A Java applet can run on any Web browser that supports Java (see the sidebar "HotJava Turns Lukewarm"), so a developer can write to a single API and be assured that the application will run in a wide variety of circumstances.

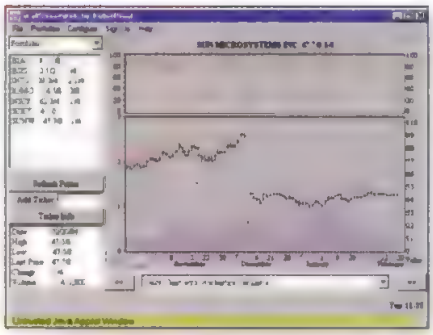
Sun's strategy is to position Java as *the* programming language for the Web, and so far Netscape Communications, Microsoft, and IBM have integrated the language into their products. Sun's next step will be to release Java Workshop, a more comprehensive development tool.

Java borrows a lot of its structure and conventions from the programming language C++, which is both good and bad. Many programmers are already conversant with C++, making for an easy transition to Java. But those without extensive C or C++ programming experience may have a difficult time.

Java 1.0 contains a slew of examples, complete with source code, but they all have to do with creating animation, such as a bouncing ball or a scrolling image. Yes, a sample spreadsheet applet is included, but it's too simplistic.

FIRST LOOKS LIVE

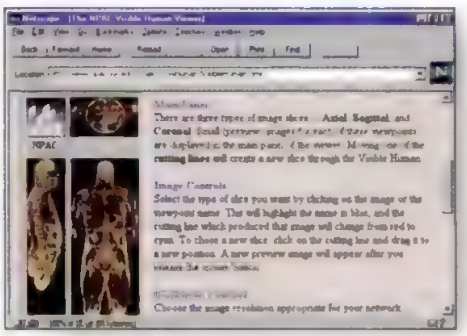
From March 25 to March 29, you can go online to discuss Sun Microsystems' HotJava with Kevin Reichard, a reviewer for *PC Magazine*. Just type GO EDITOR at any CompuServe prompt in order to join the discussion.



TAKING STOCK: *Get instant quotes from WallStreetWeb, a powerful Java applet for online investors.*

Better examples are available elsewhere on the Web. One of the most ambitious Java projects to date is Bulletproof's WallStreetWeb, an online financial service that provides instant quotes and customized charts to track your securities. It will eventually also provide brokerage services and market news (*http://www.bulletproof.com*).

The Visible Human Viewer enables you to perform a virtual dissection of the human body using high-resolution, two-dimensional slices of the body based on data collected by the Visible Human Project (*http://www.npac.syr.edu/projects/vishuman*).



SLICE OF LIFE: *The Visible Human Viewer applet allows you to select and view cross sections of the human anatomy.*

Applets can also be used to create eye-catching effects such as animated sequences, scrolling text, and slide shows. For more examples of existing Java applets, visit JARS (*http://www.surinam.net/java/jars*), which rates the top Java applets on the Web, or Earthweb's Gamelan, a clearinghouse of Java resources and links to sites with Java applets (*http://www.gamelan.com*).

Despite its potential, Java 1.0 lacks some basic tools that would make it a serious programming environment. Right now, Java is positioned as an interpreted language, as the compiler generates byte codes (à la Pascal) that are interpreted by the Web browser. This enables Java's platform-independence. It also avoids the need for a good compiler, which would help improve performance—Java applications are terribly slow.

If you're interested at all in Internet or intranet software development, you should have Java 1.0 near the top of your shopping list—but you'll need to wait for a more robust programming environment. Symantec Corp.'s upcoming Espresso Java Development Kit, which works with C++, might be worth the wait.

Java 1.0. List price: Free. Sun Microsystems Inc., Cupertino, CA; 415-960-1300; http://java.sun.com. *Circle 430 on reader service card.*

HotJava Turns Lukewarm

Whatever happened to HotJava? Sun Microsystems' World Wide Web browser, which was supposed to show the power of Java, is still around in alpha form, but it has fallen far behind in the browser battle.

Sun now positions HotJava, available from the company's Web site, more as a technology demonstration than as a serious tool or primary Web browser. In fact, even in terms of support for Java, HotJava hasn't kept pace with Netscape Navigator 2.0. HotJava can't run applets created with Java 1.0; it supports only applets written in prerelease versions of Java.

In addition, HotJava lacks much of the functionality found in Navigator 2.0 or Microsoft's recently released Internet Explorer 2.0. HotJava allows you to move between Web pages using links, but its bookmark features aren't very sophisticated. For example, you are limited to only one hot list. HotJava also lacks a full-featured e-mail client.

Sun promises that a beta version of HotJava will be available by this summer. If you want to see the power of Java, though, you're better off using Navigator 2.0.—*KR*

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BOOKS

HTML Books Spread Word of the Web

By Luisa Simone

There is a world of difference—a World Wide Web of difference—between traditional desktop publishing (DTP) and HTML (Hypertext Markup Language) authoring. Where traditional DTP concentrates on the *appearance* of text and graphics on a page, HTML authoring focuses on the *logical structure* of a document. Indeed, the only thing an HTML author can control is the document's structure.

HTML is the lingua franca of the Internet, because it can be accessed by Mac, PC, or Unix browsers. The five books in this roundup can help you master HTML authoring. They all start with simple HTML documents that rely on a handful of tags to identify text blocks as headlines, paragraphs, lists, or tables. But their goal is to teach you how to incorporate more sophisticated features (hypertext links, clickable images, digitized sound and video, and forms) into your HTML creations.

The underlying technology can be intimidating. But with the right assistance, you'll be creating sophisticated pages in no time.

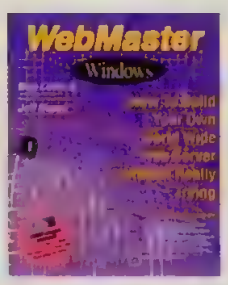
Visit http://www.zdnet.com/pcmag/discuss.htm, *March 11 to 15, to discuss HTML with the authors.*

WWW.PCMAG.COM

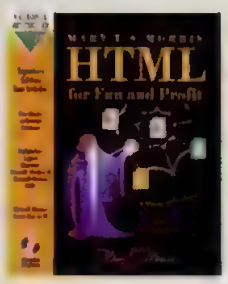
Web Design from Cut-and-Paste to Perl

● If building HTML documents tag by tag doesn't appeal to you, you'll love *The Web Page Design Cookbook* (by William Horton, Lee Taylor, Arthur Ignacio, and Nancy L. Hoft, $34.95). To quote the authors, "Never draw or type something you can cut and paste." They provide a host of templates that function as both a teaching aid and a starting point for your own HTML documents. This cookbook dedicates more pages to design and content than to URLs and CGI scripts. A section on graphics explains how symbols commonly used in the U.S. can be offensive to Web users in other countries. The included CD-ROM also contains HTML editors (HotDog and HoT-MetaL) and MIME programs (Acrobat and Director). *http://www.wiley.com;* ISBN: 0-471-13039-7.

● *Publish It On The Web!* (by Bryan Pfaffenberger, $34.95) makes HTML authoring accessible to the average Windows user. It does this largely by eschewing Unix in favor of Windows-based server software and authoring tools. Indeed, discussions of Windows 95 and the latest version of Netscape Navigator make the book feel timely. Whether delivering an overview of the Internet or specific examples of HTML code, Pfaffenberger's straightforward language makes the sometimes arcane technology understandable. The bundled CD-ROM provides trial versions of HotDog, a popular HTML editor; PolyForm, a forms-processing utility; and MapEdit, which creates hot spots on graphics. *http://www.book.uci.edu/Books/Academic;* ISBN: 0-12-553140-0.



● *WebMaster Windows: How to Build Your Own World Wide Web Server Without Really Trying* (by Bob LeVitus and Jeff Evans, $29.95) walks you through the choices involved in creating a Web site, saving you from frustrating and costly mistakes. *WebMaster* delivers only the most basic instruction on HTML coding and related tasks such as CGI scripting. But solid evaluations of Windows-based Web servers and a thorough list of Internet providers will help you get your Web server up and running. The bonus CD contains a trial version of Quarterdeck Corp.'s WebServer and a variety of authoring tools including HTML Assistant, Lview Pro, and MapThis. *http://www.book.uci.edu/Books/Academic;* ISBN: 0-12-445572-7.



● Despite its lighthearted title, *HTML for Fun and Profit* (by Mary E.S. Morris, $39.95) is a serious book. Though it concentrates on Unix servers, it does an excellent job of providing information and instruction for Windows and Mac users. The author provides software for all three platforms: a Web server (Winhttpd14), an authoring tool (HoTMetaL), and a scripting language (Perl), so that you can load and work through the many robust examples of HTML code that form the core of *HTML for Fun and Profit.* You should buy this book if you want to boost your HTML skills, plumb the depths of URL addressing, and learn how to program CGI scripts with the scripting language Perl. *http://www.sun.com/smi/;* ISBN: 0-13-242488-6.

● *Build a Web Site: The Programmer's Guide to Creating, Building, and Maintaining a Web Presence* ($34.95) was written by net.Genesis, a group of Web aficionados at MIT, and Devra Hall. The collaboration produced an excellent resource that takes an extremely high-level view of Web authoring. Not content with simple HTML coding, this book delves into the depths of CGI scripting (once again using Perl) and even provides programming techniques for those users who want to customize their own robots and HTTP servers. Only experienced programmers will feel comfortable with the technical language, Unix orientation, and long code listings in this book. It does not include a CD-ROM. *http://www.webcom.com/prima;* ISBN: 0-7615-0064-2.

NOVICE ← → EXPERT

For some people, it's enough to know that MagnaRAM multiplies their computers' memory. Others require a slightly more detailed explanation.

Dan Spear is a Quarterdeck Fellow and Senior Director of Advanced Research. He was the primary developer of QEMM, co-creator of the VCPI Specification, and holds two patents on memory management.

By Dan Spear

MagnaRAM — More Memory Without More Chips.

MagnaRAM is a utility for Windows® 95 and Windows 3.1 that gives you more usable memory. Using memory compression, MagnaRAM simply takes the physical memory on your system and stores more data in it. With MagnaRAM, you can run more and larger programs.

So how does MagnaRAM work? First, let me explain what memory compression and VxDs are all about.

Memory Compression?

If you have 1000 bytes of memory, how can you store more than 1000 bytes of information in it? MagnaRAM uses memory compression to pack up your data to fit into a smaller space.

Several programming techniques allow MagnaRAM to store data in less memory. One method involves noticing a repeating sequence of data, and storing the pattern instead of the data. For example, if you have 1000 bytes of data, all of which are the letter "A," you can represent them as (1000 A's), and save hundreds of bytes.

Open Up Windows With VxDs.

If you want to compress data stored in memory in Windows applications, you need a mechanism which is automatic and invisible — part of the operating system itself. Fortunately, Windows lets you add additional features to the operating system. How? By writing a driver called a VxD. One of the interesting things a VxD can do is enhance another VxD by replacing its functions.

How MagnaRAM Lives Up To Its Name.

MagnaRAM enhances the VxD responsible for virtual memory, which effectively increases memory by temporarily using your hard disk as if it were more memory.

MagnaRAM reserves some physical memory for a compression buffer. It hooks into the service that is responsible for reading and writing data to your hard disk for virtual memory. When the operating system wants to write a page to disk, MagnaRAM copies the data into the compression buffer and tells the operating system that everything's O.K. Later, while the system is idle, MagnaRAM crawls through its buffer compressing the data. If the buffer gets filled up, MagnaRAM writes its compressed data to disk, so you write less to disk. When the operating system needs the data back again, MagnaRAM fetches it from either the buffer or the disk, decompresses it, and hands it back. This is invisible to the applications, the virtual memory system, and even the VxD that writes the data to disk.

This process allows more data to be stored in memory without going to disk because MagnaRAM has compressed the data to a fraction of its original size. Available Windows memory increases by a significant amount, even with the same amount of memory and disk space usage. Although MagnaRAM's compression and decompression do take time, they are typically faster than disk access. System performance can vary depending on the types of applications and the degree of compression that MagnaRAM can achieve.

MagnaRAM will give you more memory; I encourage you to visit your local retailer and try out the product for yourself. For more information, give us a call at 1-800-683-6696. Or go to our website at http://www.quarterdeck.com.

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CIRCLE 339 ON READER SERVICE CARD

COLOR PRINTERS

Tektronix Phaser 550: No-Excuses Output

By M. David Stone

Tektronix just raised the bar in terms of what you should demand from a color laser printer. Until now, working with even the best color laser printer meant having to make compromises on—and occasional apologies for—output quality. Getting the Tektronix Phaser 550 for $6,995 means never having to say you're sorry.

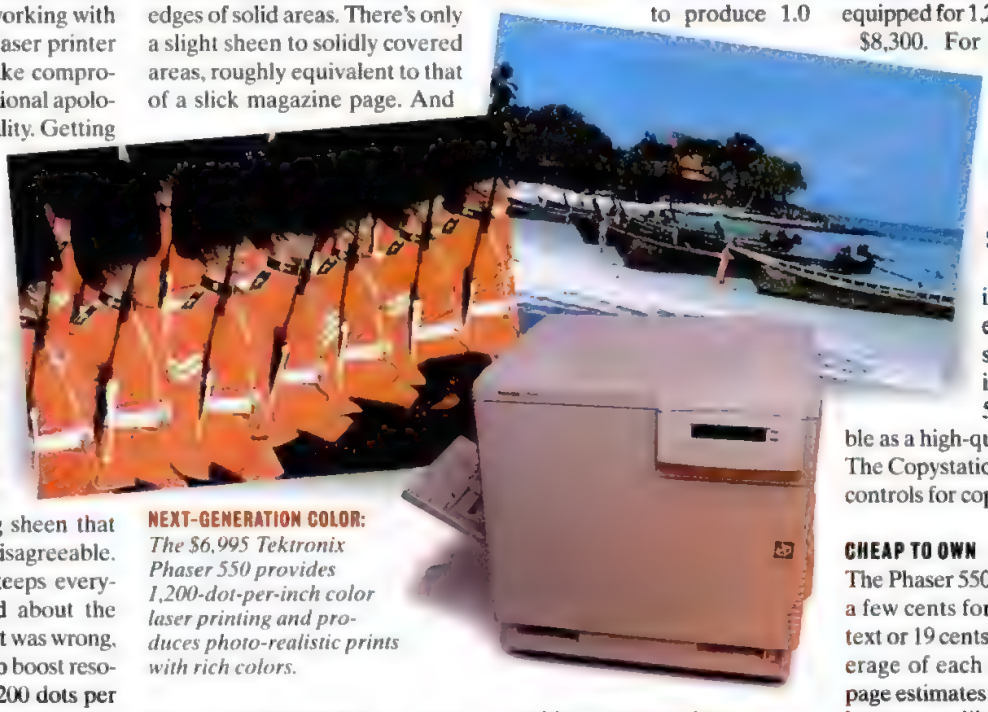
The first color laser printer from Tektronix, the Phaser 540, was notable for its easy setup and maintenance, and for its impressive specifications. Unfortunately, it printed photos with an oily-looking sheen that some users found disagreeable.

The Phaser 550 keeps everything that was good about the Phaser 540, fixes what was wrong, and adds the ability to boost resolution to 1,200 by 1,200 dots per inch (dpi). This is 16 times the resolution of the units in the new HP Color LaserJet 5 series.

The big news here lies in the output quality. Even at 600 by 600 dpi, the Phaser 550 offers what is by far the best-looking output of any color laser printer we've seen. With a variety of originals printed on standard copier paper, the Phaser 550 produced thin lines in graphics that were consistently solid and well formed, even when surrounded by other colors. Photos had true photographic quality, gradient fills were shaded gradually from one color or degree of gray to the next without banding, and solid areas were entirely filled in whether with color, black, or gray. In addition, black text was crisp, clean, and well formed, as you would expect from a monochrome laser printer.

WHAT'S NOT THERE

The Phaser 550 succeeds in several areas where its predecessors have had mixed results. Unlike most color laser printers, the Phaser 550 doesn't leave a thin dark or light band along the edges of solid areas. There's only a slight sheen to solidly covered areas, roughly equivalent to that of a slick magazine page. And even at 600 by 600 dpi, you can't see dithering patterns unless you use a magnifying glass.



NEXT-GENERATION COLOR: *The $6,995 Tektronix Phaser 550 provides 1,200-dot-per-inch color laser printing and produces photo-realistic prints with rich colors.*

Setup is just as easy for the Phaser 550 as for the Phaser 540. You simply slide the fuser and imaging units into the front of the printer, insert the four toner cartridges in the side, snap on the output tray, load the paper, and connect the cables, and you're ready to print.

The printer uses monocomponent toner, rather than the dual-component toner that you'll find in most color laser printers. This means you need only toner for each color, not toner and developer. Tektronix claims 10,000 pages per cartridge for the black toner and 8,000 pages per cartridge for each of the colors—cyan, magenta, and yellow. Most other color laser printers claim somewhere from 2,000 to 4,000 pages for each color cartridge.

Tektronix claims a 14-page-per-minute (14-ppm) engine speed for black and white and 5 ppm for color. On our tests, the printer managed a respectable 6.7 ppm for text and was able to produce 1.0 graphics page per minute in PostScript mode.

The printer also has a strictly black-and-white PCL 5 mode available. Tektronix doesn't expect many people to use it, however, and the printer ships with the mode inactive. Tektronix thus avoids paying—and charging—a licensing fee for including the mode. To activate the PCL mode, you have to obtain a free activation code from Tektronix and download it to the printer.

The basic version of the Phaser 550 includes 8MB of RAM, a 32-MHz AMD 29040 RISC controller for image processing, a parallel port, a SCSI port for an external hard disk, and 17 built-in PostScript fonts. Ethernet, Token-Ring, and combination LocalTalk/serial cards are available at prices from $245 to $895.

If you want to print in either 600- by 1,200-dpi or 1,200- by 1,200-dpi mode, you'll need the Extended Features SIMM. This $795 option brings the total number of PostScript fonts to 39 and adds other features, including print collation (which lets the printer instead of your software collate the pages).

The higher resolution requires an additional 16MB of memory, bringing the list price for a unit equipped for 1,200 by 1,200 dpi to $8,300. For printing in the fastest 1,200-dpi mode, you'll need a total of 72MB of RAM, which boosts the unit's list price to $12,570.

Another option is the $1,695 Phaser Copystation, a scanner that plugs into the Phaser 550 and lets it double as a high-quality color copier. The Copystation includes its own controls for copying.

CHEAP TO OWN

The Phaser 550's price per page is a few cents for black-and-white text or 19 cents for 5 percent coverage of each color. These per-page estimates are relatively high because, unlike most of its competitors, Tektronix includes the cost of all consumables—fuser, imaging kit, and fuser oil—but not paper. In any case, the unit still costs far less than traditional high-end color printers that use thermal wax or thermal dye technologies.

Clearly the Phaser 550 delivers on what color laser printers have long promised: Print quality is arguably in the same class as thermal dye printers'. And the Phaser 550 faces no competition when it comes to mixing color output with text in the same print job or even on the same page. If you've been waiting for a color laser printer that doesn't force you to compromise, the wait is over.

Tektronix Phaser 550. List price: $6,995. Requires: PC with parallel port. Tektronix Inc., Wilsonville, OR; 800-835-6100, 503-682-7377; fax, 503-682-2980. *Circle 402 on reader service card.*

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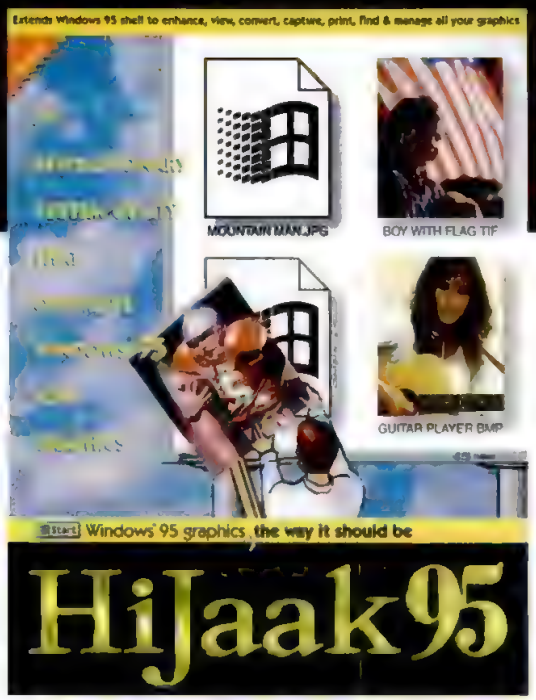

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CIRCLE 338 ON READER SERVICE CARD

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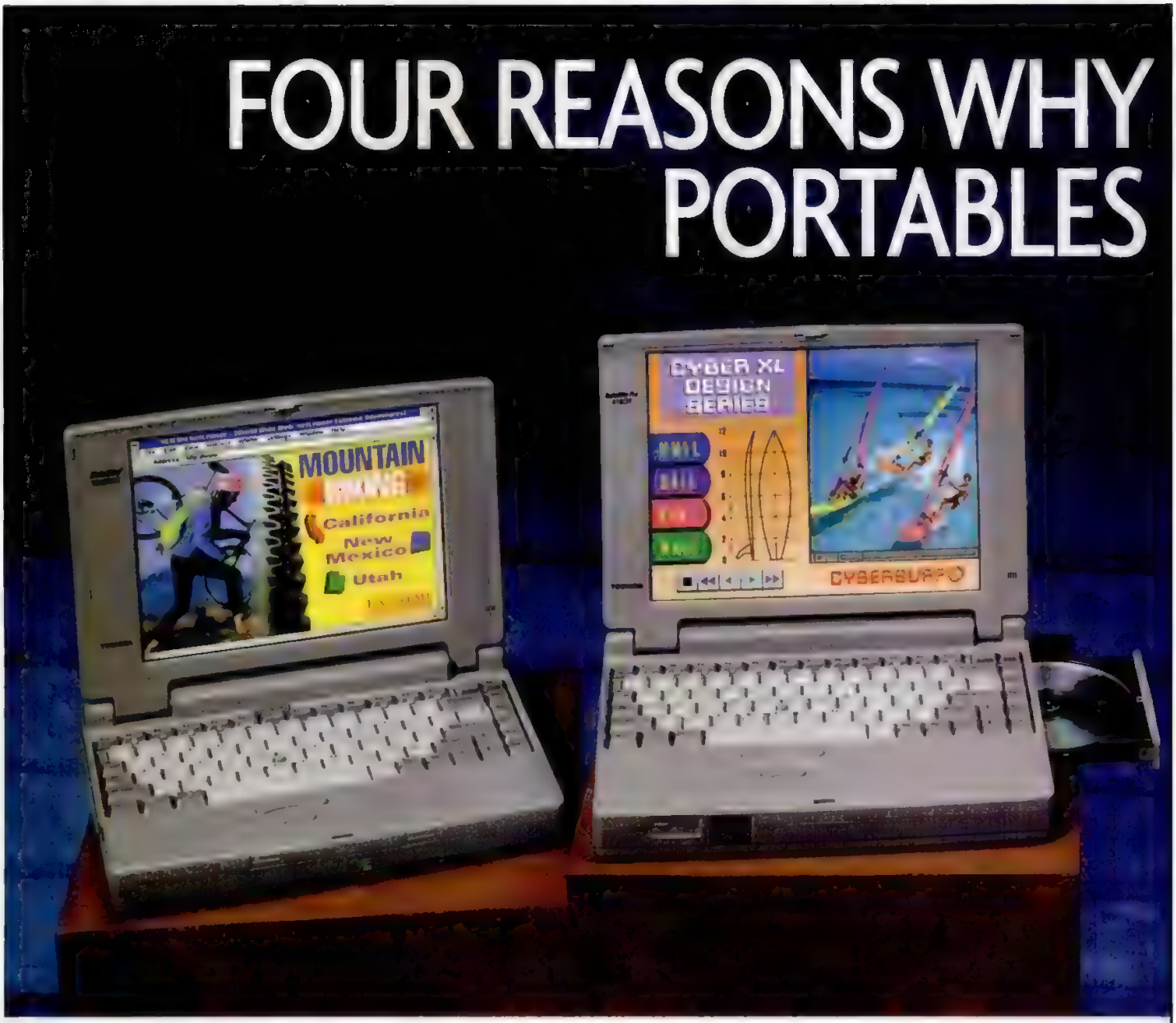

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CIRCLE 379 ON READER SERVICE CARD

NETWORKED PRINTERS

Xerox's DocuPrint 4517mp: Fast, Affordable Workgroup Printing

By Alfred Poor

Departmental laser printers are made to meet the demands of multiple users, but few can match the flexibility and compact design of Xerox Corp.'s DocuPrint 4517mp. And at an estimated street price of $3,200, the DocuPrint 4517mp is also an impressive value.

The basic specifications are those you might expect for a shared printer: a 17-page-per-minute (17-ppm) print engine, a 250-sheet standard paper tray and a 100-sheet manual-feed tray, and 600-dot-per-inch (600-dpi) resolution. Paper handling can be expanded by adding one or two optional 500-sheet paper trays and a 500-sheet offset tray. And later this year, you can get an optional locking, ten-drawer mailbox/collator (see the sidebar "Can Your Printer Keep a Secret?").

The real pluses of the DocuPrint 4517mp become evident when you look deeper. Like many departmental lasers, the DocuPrint 4517mp offers duplex printing as an option. The difference is that the Xerox printer's duplex unit is very small, can be installed by the average user in just minutes, and sells for less than $400.

PERSONALIZED PRINTER: *The DocuPrint 4517mp grows with your workgroup with output options, duplex printing, and two PC Card slots.*

The DocuPrint 4517mp we tested adds Adobe PostScript Level 2 support, 6MB of memory, and an Ethernet interface (LocalTalk and Token-Ring are optional). For network installations, the printer ships with Document Services for Printing (DS/P) Version 2.0, a Windows application that allows users and network administrators to control multiple printers.

The printer accepts an optional hard disk and is equipped with two PC Card slots, which can be used to store fonts, forms, or other print macros, such as signatures or logos.

We tested the DocuPrint 4517mp with the optional duplex and an additional 4MB of memory (a total of 10MB). This configuration carries an estimated street price of $3,200.

On our standard Print Speed test, the printer posted a speed of 13.9 ppm under PCL and 13.8 ppm using PostScript—competitive scores for a 600-dpi printer in this class. The DocuPrint 4517mp fared equally well on the CorelDraw graphics test page, achieving ratings of 2.4 graphics pages per minute for PCL and 1.7 gppm for PostScript.

Print quality was well above average. The DocuPrint 4517mp incorporates DP-Tek's TrueRes image enhancement technology to smooth the jagged edges for text and line art, plus Xerox's Quad Dot technology, which improves the quality of gray-scale images. The TrueRes feature successfully smoothed text even when printing fonts in small point sizes, and gray-scale images demonstrated fine, smooth dithering. Occasionally, we noticed some faded streaks in large areas of solid black.

The printer is rated for a maximum of 50,000 pages a month. The unified toner/drum cartridge is rated for 10,000 pages at 5 percent coverage, and the other service component, the fuser, is rated for 200,000 pages. The unit can handle paper up to legal size and can also accept transparencies and labels.

If you're looking for a fast and flexible network printer, the DocuPrint 4517mp is a strong candidate.

DocuPrint 4517mp. Estimated street price: $3,200. Requires: 6MB RAM, Microsoft Windows 3.1 or later, Windows 95, or Windows NT. Xerox Corp., El Segundo, CA; 800-349-3769; http://www.xerox.com. *Circle 407 on reader service card.*

Can Your Printer Keep a Secret?

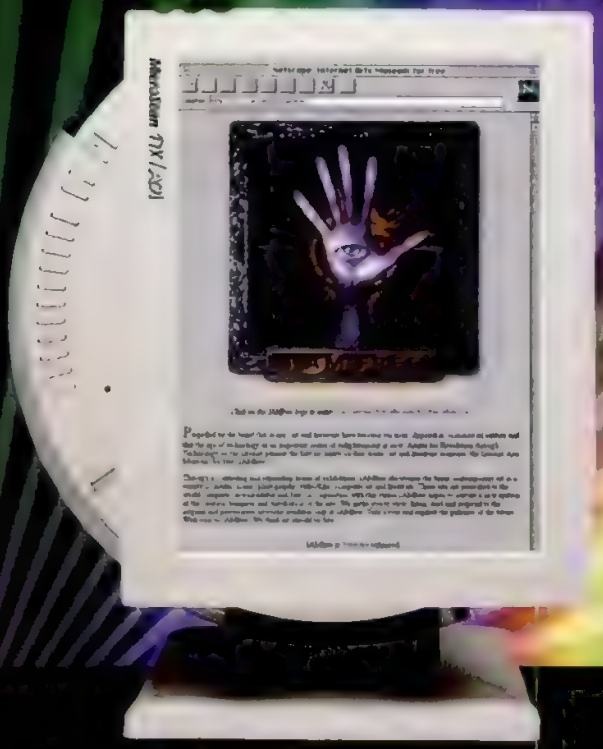
Networked printers are an efficient way to provide fast, high-quality output for workgroups or entire departments. But they afford little privacy from prying eyes.

Now Xerox has come up with a solution for the DocuPrint 4517 series: an optional mailbox/collator that combines the advantages of a network workhorse with the privacy of a personal printer. Multibin output trays are nothing new, but Xerox's mailbox/collator has ten locking trays, which can be assigned individual passwords so that users can send their print jobs to their own secure output bins. In addition to keeping your documents out of plain view, the mailbox/collator eliminates the tedious task of sifting through a crammed output tray to locate your document.

You can also assign passwords to some bins and leave others unlocked for general use. Or the unit can be configured to collate multiple copies. An LED on the front panel identifies which bins are locked or unlocked.

The mailbox/collator mounts on top of the DocuPrint 4517 models, preserving the printers' modest footprint. The $1,099 option was not ready in time for this evaluation, but Xerox says it should be available shortly.—*AP*

PRINT AND LOCK: *The DocuPrint 4517mp provides the security of a locked output tray.*



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High-Quality Feature Set

The MicroScan 17X also has many other things to flip over. Like a 17" CRT display with a 16" diagonal viewing area, 1024 x 768 resolution, flicker-free 76Hz performance, .28mm dot pitch, microprocessor digital controls, even Plug-n-Play compatibility. It's a feature set you won't find in competitively priced monitors. And since ADI builds monitors for leading PC companies worldwide, you know you're making a quality investment for the long haul. The MicroScan 17X is also backed by a three-year warranty. Best of all, you don't have to be a Web Master to get one. Just call 1-800-228-0530 for your nearest dealer.

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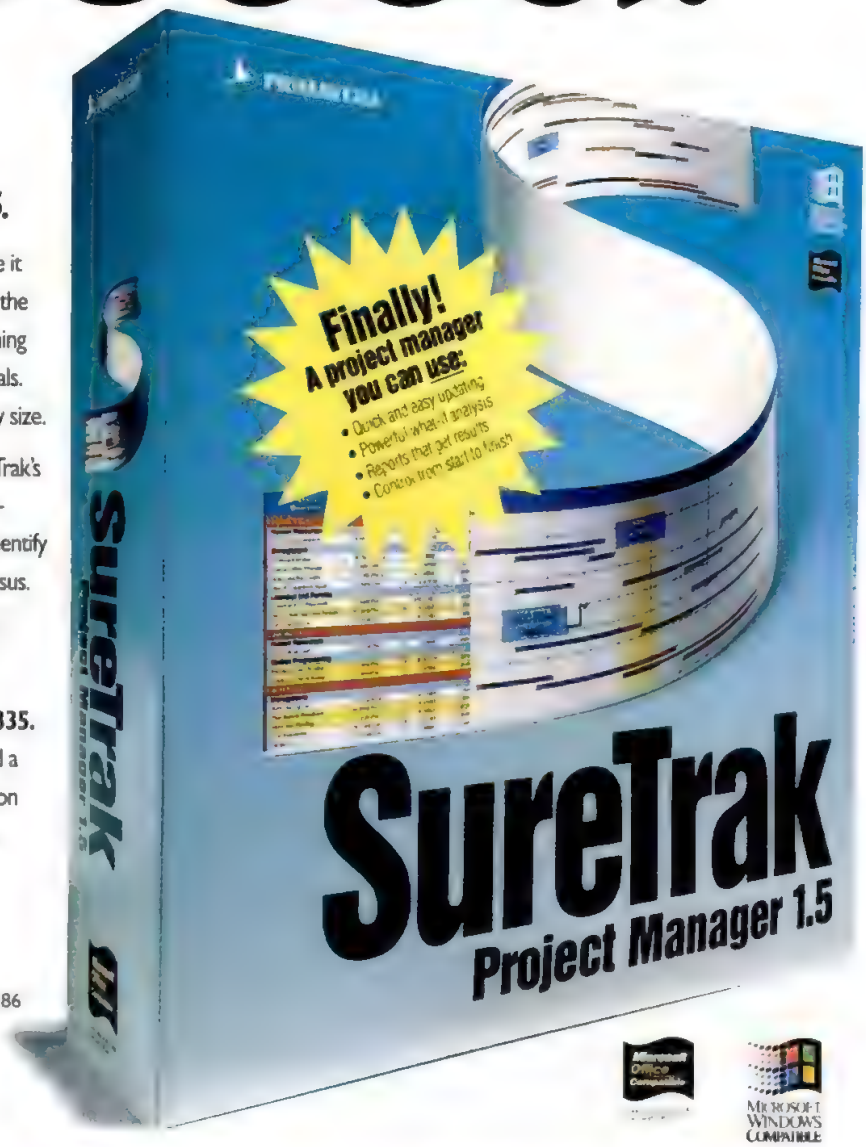

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CIRCLE 148 ON READER SERVICE CARD

OS/2 SOFTWARE

ZOC Automates Communications The Way Only OS/2 Can

By Edward Mendelson

BMT Micro EmTec's $95 communications package for OS/2, ZOC, gives advanced users unique customizability and automation combined with impressive efficiency and speed.

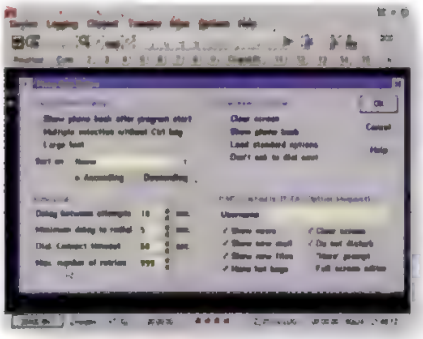
ZOC's interface resembles a GUI version of fast, keyboard-oriented, character-based packages such as the original ProComm and HyperAccess. The program's customizable toolbar and a button bar can be configured to call any number, download a file, or run a REXX program. ZOC is so densely integrated with OS/2 that it can communicate through a Named Pipe as well as through a modem, direct connection, or ISDN line.

Unique automation features include a "snippet" window that monitors incoming data for filenames, Internet addresses, or CompuServe IDs. As you type, ZOC can expand abbreviations into longer strings, and it can automatically respond to incoming prompts with preset strings, even when you're not running a script.

The phone book lets you cycle through a series of selected numbers, with different retry options for each, until all the numbers have been reached. Options for fine-tuning the program include a menu in which you tell the program what to do when you disconnect from a remote site and a feature that disables your fax program's auto-receive feature when you're using ZOC.

You control ZOC from its top-line menus, keyboard macros, or native scripting language, or from OS/2's native programming language REXX. The scripting language is adequate for simple tasks and is used for the log-on scripts that ZOC records automatically when you dial a new BBS or online service. By using REXX for more advanced automation, ZOC takes advantage of a batch language that is already familiar to advanced OS/2 users and is easier to learn than the C-style languages used by recent Windows-based communications programs.

Built-in transfer protocols include Zmodem, and external modules support CompuServe B+ and Kermit. An ingenious option lets you use external DOS-based transfer modules. The only terminal emulations available are ANSI, TTY, and VT102, but each is highly customizable. A built-in viewer displays .GIF and .JPG files during downloads. Chat mode is elegantly supported, and host mode is supported through a REXX program.



CUSTOM COMMUNICATOR: *ZOC provides extensive retry options and allows you to tell it what to do after you log off.*

ZOC's interface isn't as automated as its communications features. If you want to rearrange the button bar, for example, you'll have to cut and paste the button names and commands by hand.

Beginners will be better off with a more graphical interface, but experienced OS/2 users won't find any communications package more powerful than ZOC.

ZOC. List price: $95. Requires: 4MB RAM, 2MB hard disk space, OS/2 2.0 or later. BMT Micro EmTec, Wilmington, NC; 800-414-4268, 910-791-7052; fax, 910-350-2937. *Circle 404 on reader service card.*

AUTHORING TOOLS

RoboHelp 95 Assists Your Help Files for Windows 95 Apps

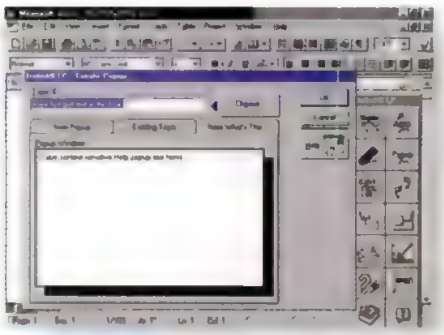
By Craig Stinson

In its latest incarnation, Blue Sky Software's WinHelp Office 95 remains the most comprehensive set of Windows help–authoring tools available. Priced at $599, the WinHelp Office 95 suite lets writers generate help files without tackling Windows' help compiler.

RoboHelp 95, the centerpiece of the suite, works closely with Microsoft Word for Windows and the help compiler. You simply click on the custom tool palette to generate help topics, links, pop-up messages, and so on. RoboHelp turns your text into an .RTF file (without requiring any knowledge of the help compiler's formatting requirements) and then compiles that file into a help document.

WinHelp Office 95 includes a tidy bundle of goodies: a tool for porting Windows 3.*x* help files to Windows 95 or Windows NT, a 400-page book describing the new help compiler in detail, a kit for adding .AVI and .WAV files to help documents, a decompiler, templates for turning source .RTF files into print documentation, a library of useful icon and button bitmaps, an .OCX control for adding context-sensitive help to applications created in Visual Basic and other OLE-compliant environments, a tool for linking help text to World Wide Web sites, and more.

All components of the suite come in both 16-bit and 32-bit flavors, allowing you to create help files for both platforms. RoboHelp 95 supports all the new features of the Windows 95 help engine, including the contents tab, "What's this?" context-sensitive help, shortcut buttons, authorable buttons, secondary-window enhancements, keyword searches, links between multiple help files, and the new compiler's enhanced graphics capabilities. Users porting Windows 3.*x* help documents will particularly appreciate RoboHelp's new drag-and-drop contents composer, which lets you build a multilevel contents tab by manipulating entries in an outline.



WINDOWS HELPER: *RoboHelp 95 takes advantage of the many new features in Windows 95's help engine, including context-sensitive pop-up messages.*

Blue Sky's documentation is thorough and approachable, and it includes a half-hour training video. WinHelp Office 95 is a huge time-saver and frustration-reducer for both novice and experienced help authors.

WinHelp Office 95. List price: $599 (RoboHelp 95 only, $499). Requires: 8MB RAM, 10MB hard disk space, Microsoft Word for Windows. Blue Sky Software, La Jolla, CA; 800-459-2356, 619-459-6365; http://www.blue-sky.com. *Circle 405 on reader service card.*

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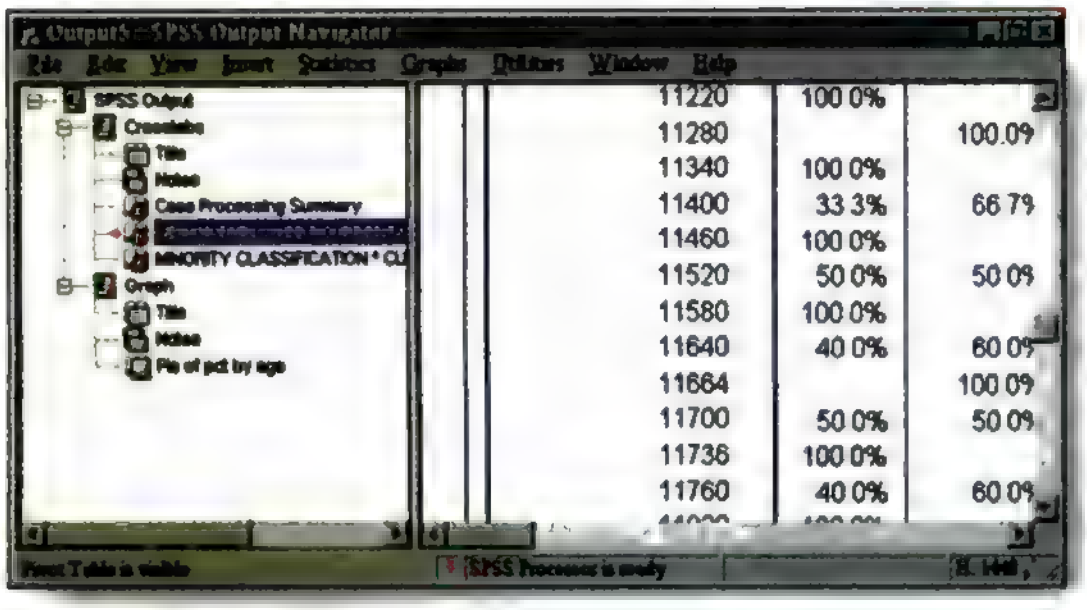


STATS WITH A VIEW: *SPSS's Output Navigator makes it easy to find a particular table or graph.*

STATISTICS

SPSS 7.0 Puts a Friendly Face on Its Powerful Statistics Package

By Barry Simon

SPSS has long had a reputation as the most powerful statistics package available—if less than user-friendly. With the release of SPSS 7.0 for Windows, which has a list price of $695, SPSS has completed its transition to a flexible and even easy-to-use statistics program.

Especially noteworthy in this new version are comprehensive Windows 95 support, a wonderful pivot-table facility, and impressive control over the formatting of text and graphs. At one time, all SPSS actions were controlled with complex scripts. These scripts are still there for batch processing and backward compatibility, but the revamped interface is based completely on point-and-click, dialog boxes, and drag-and-drop. Version 7.0 is so easy to use that many business users will want this program for extending analyses when their spreadsheets run out of steam.

BRING DATA TO LIFE

The new pivot-table feature lets you slice and dice your data in a variety of ways. The output of a statistical procedure can often be multidimensional. For example, you can classify customers by region and business, then work with the number of orders, average dollar value, and total dollar value.

The output is displayed in rows and columns, with subcolumns for secondary variables. For complex data, you'll want to add a third dimension, which SPSS calls a *layer*. Along the sides of the array are icons, one for each variable. Changing a variable from a row to a layer is as simple as dragging its icon to the desired location, and you can change which layer is viewed by simply clicking on one of the layer-variable icons.

The results of your analyses are displayed in a Navigator window similar to Windows 95's Explorer, with an outline that lists the output tables and graphs on the left and a Quick View–like preview pane to the right. This makes it easy to switch among different analytical and graphical views of your data. You can reorder the output by dragging items in the outline pane.

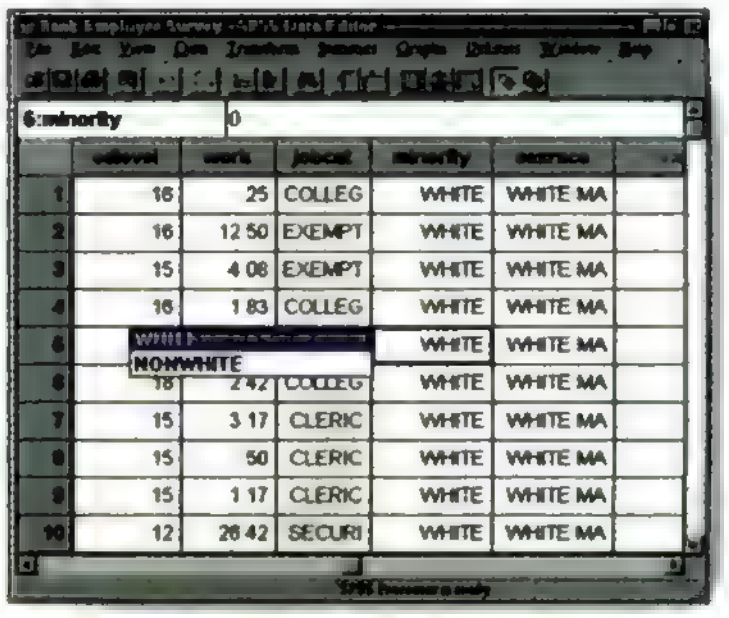
Tables can be formatted with a variety of colors, fonts, and borders. The program comes with 20 built-in table styles (called TableLooks), and it's easy to make custom tables as well. Once you find the table you want, you can easily transfer it to your documents, since SPSS is a fully OLE 2.0–compliant server.

Not only can you use in-place editing for SPSS objects inside your word processor, but you can leave objects as OLE scrap on your desktop.

This support of OLE scrap is one example of the comprehensive integration with Windows 95, which also includes support for long filenames and extensive right-click menus. On the whole, the dialog boxes are logically laid out, and there are extras such as a drop-down list of recently used dialog boxes.

The only interface oddity is the extensive use of shift-click shortcuts. Believe it or not, one shortcut actually requires you to hold down the Ctrl, Alt, and Shift keys while simultaneously left-clicking the mouse.

The $695 basic package comes with a variety of statistical procedures and graphs built-in. Included in the package are frequency counts and histograms, crosstabs, grouped means, t-tests, one-way ANOVA, bivariate and partial correlations, and linear regression. In addition to basic bar, pie, and area charts, the program includes box-whisker and Pareto charts, and 3-D scatter and probability plots. The probability plots, which include Gamma, Lognormal, and Weibull, are new to this version. Also new is the ability to print several charts on one page.



DATA DETAILS: *With the Data Editor, you can select from a pop-up list of choices for a given data value.*

The Data Editor in SPSS has a great deal of smarts: Each variable can have labels associated with numbers. For example, when data is input so that box one is Male and box two is Female, you can tell the editor that 1=Male and 2=Female. You can switch between a label view and a raw-data view from a toolbar button. Data value translations are systematically used in all tabular and graphics output. This translation facility is especially useful for machine-read survey forms.

SPSS EXTRAS

The Advanced Statistics package has been upgraded to include General Linear model procedures, such as univariate ANOVA and ANCOVA. These statistical functions are intended to replace the MANOVA analysis in previous versions. A $395 Tables module enhances SPSS's pivot-table and output features. Other modules (Categories, Professional Statistics, and Trends) have been updated to work with Version 7.0, but they gained no new functionality.

SPSS offers solid import and export of Excel data—an important feature for those using the program to extend their spreadsheets' capabilities. You can import data in Excel 4 format or ODBC. The extensive help file is augmented by context-sensitive "What's this?" buttons that adorn Windows 95 applications. But even with the included help, there is no magic road through the complex world of statistics. The program will not tell you, for example, when to use ANOVA. To use SPSS's tools most effectively, you will need some background in statistics.

SPSS 7.0 for Windows delivers on the company's promise of real stats, real easy, and it will become an essential tool for anyone who needs to do statistical analysis.

SPSS 7.0 for Windows. List price: $695. Requires: 8MB RAM (16MB recommended), 25MB hard disk space, Microsoft Windows 95 or Windows NT. SPSS Inc., Chicago, IL; 800-543-2185, 312-329-3500; http://www.spss.com. *Circle 401 on reader service card.*

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Keycode #04218

intel inside pentium processor

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Pricing is not discountable. "The VeriTest Cross-Country v2.0 test simulates typical executive use of Microsoft Office® applications in Microsoft Windows® 3.11 during an airplane flight. Power management was enabled and 8MB RAM was installed. VeriTest, inc. is located in Santa Monica, CA. †For a complete copy of our Guarantees or Limited Warranties, please write Dell USA L.P., 2214 W. Braker Lane, Building 3, Austin, TX 78758. °Business leasing arranged by Leasing Group, Inc. *Prices and specifications valid in the U.S. only and subject to change without notice. Microsoft, Windows and the Windows logo are registered trademarks of Microsoft Corporation. The Intel Inside logo and Pentium are registered trademarks of Intel Corporation. ©1996 Dell Computer Corporation. All rights reserved.

Second Looks

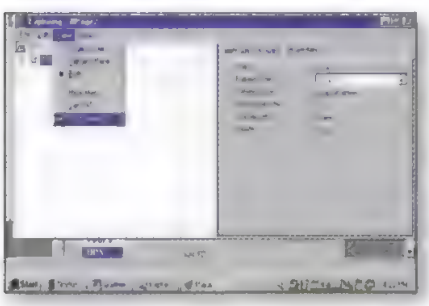
LIVING WITH THE PRODUCTS WE REVIEW

By Brian Nadel

DATABASES

Paradox 7.0: Pin and Bear It

Our initial review of Paradox 7.0 described the database as a big step forward for Borland (First Looks, February 6, 1996). In the last several weeks, users have written to Second Looks to describe its sometimes quirky behavior, particularly whenever they were working with the Object Explorer pinned in place.

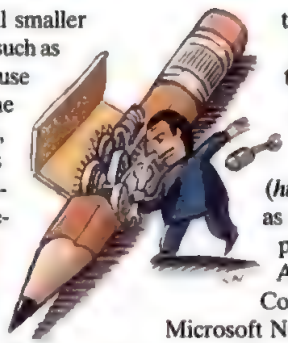


For example, if you're building a database application with the Object Explorer pinned and you open a property sheet for a new field, or you change a Frame to 3-D style, a protection fault could result. Borland has acknowledged this problem and has expanded the list of risky behavior to include working with a pinned Object Explorer and opening a new script, toggling to a new report, or toggling to a script and then closing that script.

Borland has prepared a patch that fixes these problems. The file, bi34.zip, contains a 130K executable program, Pdx7upd1.exe, which loads itself, and includes details on which files are replaced. The patch is available from Borland's library on CompuServe and from the company's Web site (*http://www.borland.com*), and should make Paradox programming a lot less troublesome.

ILLUSTRATION

Corel Draws a Sharper Picture



Along with several smaller application quirks, such as not being able to use text files for the wording in charts, CorelDRAW 6.0 is not entirely compatible with its predecessor, users have complained. For example, CorelDRAW 6.0 is not able to open some files saved in CorelDRAW 5.0 that contained bitmapped images (First Looks, November 7, 1995). You can always import the material into CorelDRAW 6.0, but this can be a time-consuming nuisance.

Corel has issued a maintenance release that brings Versions 5.0 and 6.0 into closer harmony, lets you drop .TXT files directly into CorelDRAW 6.0 charts, and includes a plethora of smaller feature enhancements. Information about the update, called Build 169, is available on the company's Web site (*http://www.corel.com*) as well as on the company's forums on America Online, CompuServe, and the Microsoft Network. Registered users will receive the update by mail or you can call Corel at 800-772-6735 to order it.

BUG BRIEFS

PROBLEM

▶ Some Web URLs get garbled beyond recognition in Netscape Navigator 1.2

SOLUTION

Netscape recommends reinstalling your Windows 95 fonts to solve the problem.

PROBLEM

▶ Version 2.0 of TeleMagic Enterprise for Windows has trouble working with complex dialing patterns, such as a non-area code phone number that is actually a long distance call.

SOLUTION

TeleMagic Version 2.0a now can account for variable long distance dialing patterns. The two-disk update works in the program's contact manager and fax server, and will be mailed to registered users.

MACINTOSH GRAPHICS

Drivers (Like Time) March On

When we reviewed Apple's Power Macintosh 9500 we were impressed with the system's speed, as well as its industry-standard PCI bus architecture for graphics (First Looks, September 12, 1995). In the intervening months Apple has started using the Diamond Multimedia PCI-based Javelin 3000 video card, which is based

on the same S3 Vision968 graphics controller as several Diamond PC cards.

Along with using the best peripherals from the PC world come the inevitable quick-change–artist drivers that are updated frequently to increase performance and add new features. The latest revision of the Javelin 3000 drivers, Version 1.0.5, provides a shot in the arm for users of Microsoft Word and Adobe Photoshop because of improved scrolling. In addition, the new drivers handle the color conversion from YUV to RGB better, resulting in more realistic QuickTime video performance—that is, if you're using Version 2.1 or later.

You can get Version 1.0.5 of the Javelin drivers at Diamond's Web site (*http://www.diamondmm.com*), its FTP site (*ftp.diamondmm.com*), or the company's forum on America Online.

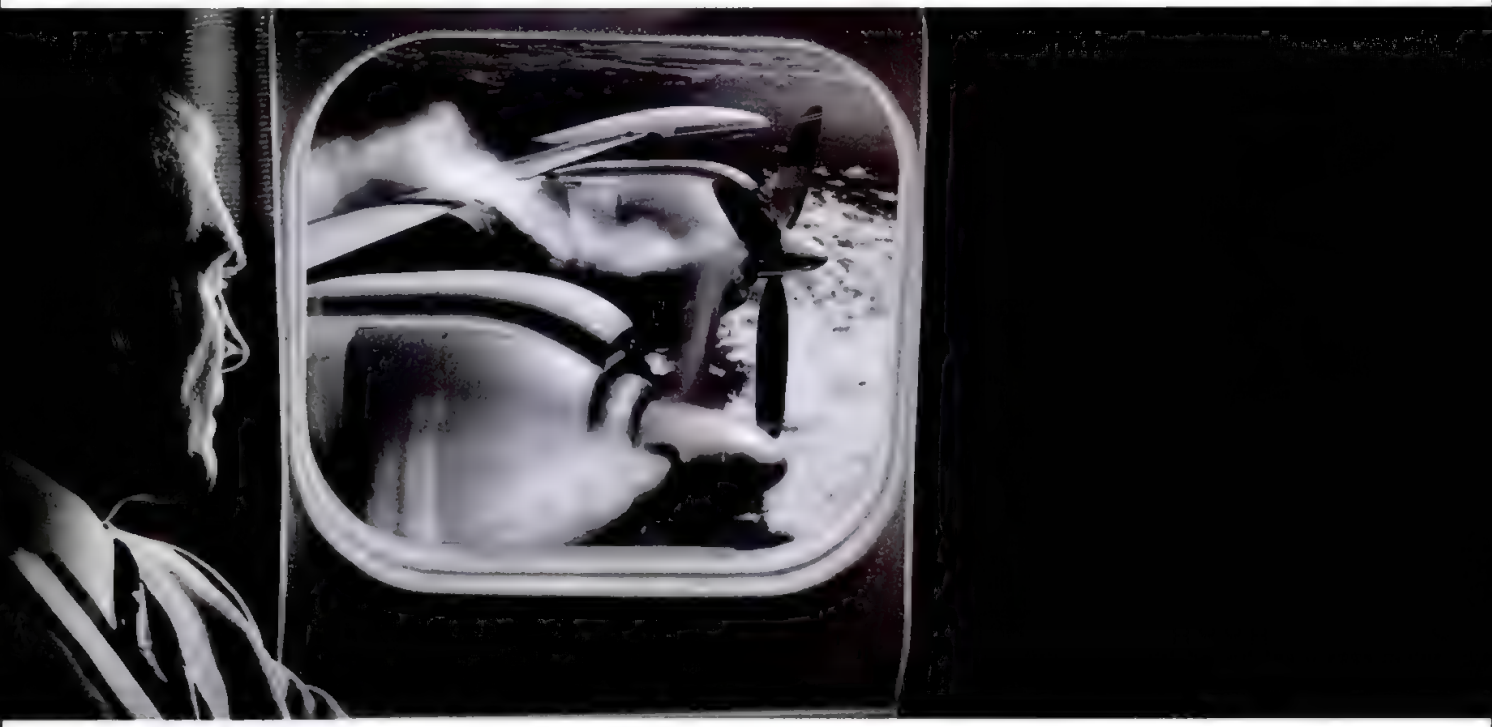
LOOKING AHEAD

Tell me what you love and hate about these products and we'll share the information in future issues • Apple PowerBook 5300 • Color ink jet printers • EZ SCSI 4.0 • Flowcharting programs • HP OmniGO 100 • IBM ThinkPad 760 CD • Multifunction peripherals • Partition Magic • Pentium Pro PCs • Quad-speed CD-ROM drives • SoftWindows • Windows 95 Utilities • ZDS Z-NoteFlex. Contact Nadel directly via MCI Mail (556-1500), CompuServe (72241,1616), or on the Internet at BNadel@zd.com.

ILLUSTRATION BY ROBERT NEUBECKER, PHOTOGRAPH BY THOM O'CONNOR

COMPAQ

Has It Changed Your Life Yet?



The problem with trouble is that usually by the time you find out about it, it's too late. Not so with Compaq Intelligent Manageability. Compaq Intelligent Manageability is a superior collection of preinstalled features and tools found only on the Compaq Deskpro. Together, they work to detect and eliminate a variety of potential problems on your network before they become real ones. Fault Management features like our IntelliSafe drive, which not only notifies you of impending failure but also backs itself up, minimizing loss of mission-critical data

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and PC downtime. And Asset Management, whose features help you keep track of hardware and software across the network from the comfort of your desk. Because all the information you need can be delivered remotely to your PC. Compaq Intelligent Manageability also includes a wide range of security features designed to keep your network secure. Which all adds up to providing the best and most comprehensive solution for managing PCs and predicting trouble on your network. Because when there's trouble, don't you want to know about it–before it happens?

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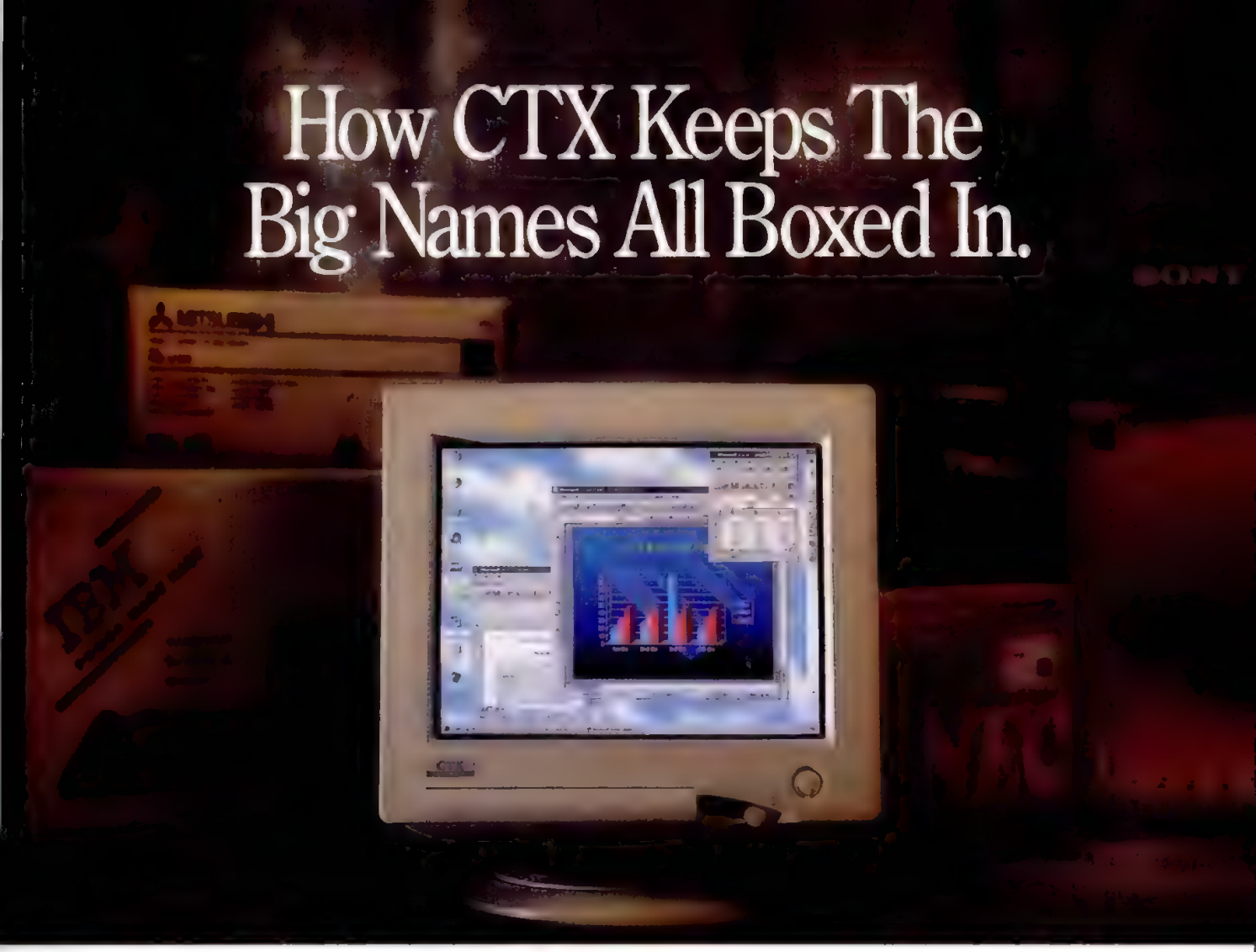
How CTX Keeps The Big Names All Boxed In.



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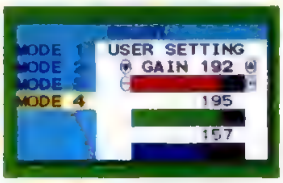

You'll be amazed at its picture quality. Compare its precision and clarity, center-to-corner and edge-to-edge, with any other monitor.

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1765GMe Monitor June 1995

1765GMe Monitor September 1995

1785GM Monitor March 1995

1785GM Monitor May 1995

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Melissa J. Perenson

Point-and-Shoot Pointers

TIRED OF AWKWARD MOUSE WIRES CONSTRICTING YOUR movements during presentations?

AM Group Corp.'s $199 **Star-Track** is a convenient cordless trackball that makes remote cursor operation a breeze. Instead of using radio-frequency waves, as some wireless devices do, Star-Track utilizes infrared technology. It is sleek and comfortable for one-handed operation, and you can control your PC from up to 15 feet away at 90-degree angles (plus or minus 45 degrees). A T-switch lets you switch back and forth between the Star-Track and your mouse.

RemotePoint Plus, from Interlink Electronics, takes a very different approach. This $199 device, which also uses infrared, can work up to 40 feet away from the receiver and provides a pressure pad for 360-degree cursor control. In addition to the two standard mouse buttons, the elegantly designed RemotePoint Plus offers four extra buttons, which are programmable for point-and-click access to 15 software packages when using Interlink's VersaPoint Plus software.

AM Group Corp., Irvine, CA; 714-261-9971; fax, 714-261-9970. *Circle 410 on reader service card.*

Interlink Electronics, Camarillo, CA; 800-340-1331, 805-484-1331; fax, 805-484-8989. *Circle 411 on reader service card.*

Pen Tablet

MOBILE COMPUTING ENters the Windows 95 age with Fujitsu Personal Systems' $3,495 pen-based color tablet PC, the **Stylistic 1000.** This 3.5-pound device comes with an AMD 486 100-MHz DX4 CPU, a 260MB

hard disk, 8MB of RAM, one Type III PC Card slot, and a lithium ion battery pack. The system is preloaded with Windows 95 and Microsoft's Pen Services 2.0. **Fujitsu Personal Systems Inc.,** Santa Clara, CA; 800-831-3183, 408-982-9500; fax, 408-496-0609. *Circle 412 on reader service card.*

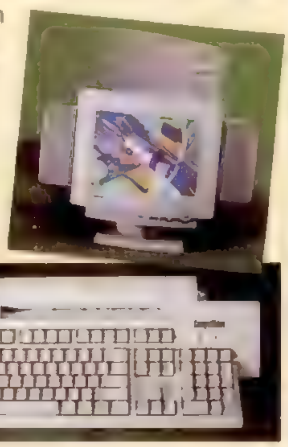
PHOTOGRAPHY BY THOM O'CONNOR

HOT PROSPECT

Compaq's Dream System

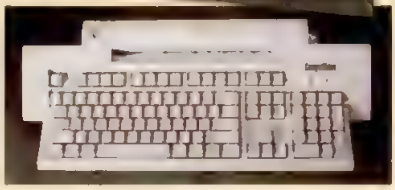
If you've been waiting to buy that home or small-office PC, Compaq Computer Corp.'s new Presario offerings might just be what you've been waiting for.

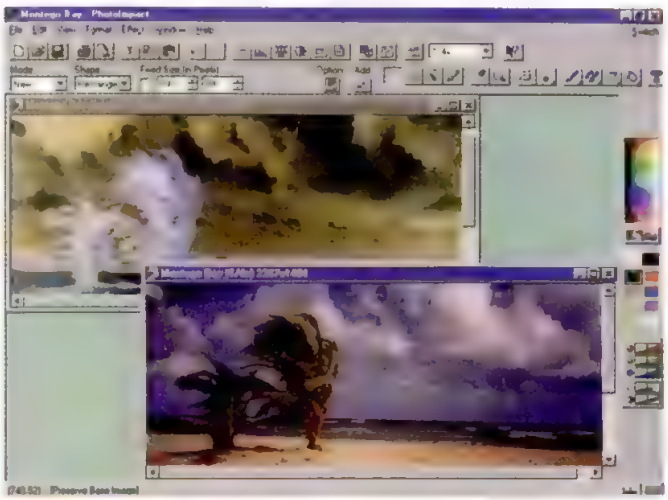
At a basic-configuration price of $2,199, the **Compaq Presario 7232** features a Pentium 120-MHz chip, a 1.6GB hard disk, 16MB of RAM, a quad-speed CD-ROM, a 28.8-Kbps modem, Spatializer 3D sound, and soft-MPEG support. You also get the innovative Scanner Keyboard, which can be purchased separately as a $349 add-on to other Compaq systems. The Scanner Keyboard has a sheet-fed gray-scale scanner based on Visioneer's scanner engine, PaperPort VX, which is housed in the upper extremity of the keyboard.



If you already have a scanner, then consider Compaq's Presario 9240. Priced at $2,799, the system includes a Pentium 133-MHz chip, a 1.2GB hard disk, 16MB of RAM, 256K of secondary cache, and most notably, a rewritable optical PD-CD drive.

Compaq Computer Corp., Houston, TX; 800-345-1518; http://www.compaq.com. *Circle 423 on reader service card*





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WHEN UPGRADING ITS POPular image editor, Image Pals, Ulead Systems completely overhauled the package. The result: **Ulead PhotoImpact 3.0.** At $199, the 32-bit PhotoImpact offers an intuitive interface and a robust feature set, including a collection of five style-and-effects galleries; tools for straightening, cropping, and correcting an image; and tools that walk you through the editing of your images. You'll also find OLE 2.0 support and 99 levels of undo. **Ulead Systems,** Torrance, CA; 800-858-5323, 310-523-9393; fax, 310-523-9399. *Circle 408 on reader service card.*

Sales Manager

WINSALES' NAMESAKE CONtact manager caters to the needs of businesses that organize and analyze their sales-client data. Using **WinSales 3.1**'s Universal Outbox, you have the ability to automate the capture of requests or survey data collected on your home World Wide Web page. You can then apply the appropriate action plan to that request. **WinSales Inc.,** Bellevue, WA; 206-747-2464; fax, 206-747-2955. *Circle 409 on reader service card.*

The Circle of Sound

THE FUTURE OF SOUND LIES IN NAKAMICHI AMERICA Corp.'s futuristically shaped speaker system, the $199 **Nakamichi SP-3d.** A compact audio speaker system designed for use with PCs, the Sound Blaster–compatible SP-3d utilizes SRS Labs' Sound Retrieval System to provide three-dimensional sound. The three-piece system consists of a pair of compact, magnetically shielded, and fully adjustable satellite speakers for medium- to high-frequency sound and a subwoofer for bass frequencies. Each component is powered by a separate amplifier. The subwoofer's facedown orientation, coupled with an integrated reflector, helps the unit maintain consistent and uncompromised sound quality. A host of controls are housed on the right speaker, including those for power, volume, and balance, a hardware-bypass switch, and an SRS on/off switch.

Nakamichi America Corp., Torrance, CA; 310-538-8150; fax, 310-324-7614. *Circle 413 on reader service card.*

Net Education

EVERYONE'S GOING ON THE Internet, but not everyone has the same goals and needs while online. TeacherSoft recognizes this; hence the origin of **InterGO**, a $99 integrated suite of Internet software utilities designed specifically for students, parents, and educators.

InterGO uses an intuitive and familiar-looking interface for each of the different components, which include a Web browser; the InterGO Newsroom, which pulls news from Usenet newsgroups, Web sites, and mailing lists; and integrated e-mail with a spell-checker and support for attachments. The InterGO Virtual Library lets your organize your bookmarks based on subjects, as though they were books in a library, while a Treasure Map helps kids find new and different Web sites. The KinderGuard security system blocks access to undesirable Web sites. Also included are *The Columbia Encyclopedia*, Fifth Edition, *The American Heritage Dictionary of the English Language*, *Roget's II: The New Thesaurus*, and more.

TeacherSoft Inc., Dallas, TX; 214-424-7882; info@intergo.com; http://www.intergo.com. *Circle 422 on reader service card.*

Give the Boot to Viruses

FRUSTRATED BY REPEATED boot-sector-virus system infections? McAfee's $35 **BootShield** prevents boot viruses such as AntiEXE and AntiCMOS, which cause the greatest percentage of reported system infections. BootShield copies itself into your system's boot sector and relocates the boot-sector information to a hidden and more secure area of your hard disk. When a boot-sector virus is detected, you can safely delete the virus.

McAfee, Santa Clara, CA; 408-988-3832; fax, 408-970-9727; http://www.mcafee.com. *Circle 415 on reader service card.*

Catch the Ergonomic Wave

CIRQUE CORP. TAKES ITS IMPLEMENTATION OF THE KEYboard-with-built-in touch pad (First Looks, December 19, 1995) several steps further with the $129 **GlidePoint Wave Keyboard.** With a gentle curve and an angled, split-key keyboard that resembles the ergonomic design of the Microsoft Natural Keyboard, this all-in-one 109-key keyboard also features Cirque's GlidePoint touch pad and additional conveniently placed extra buttons for backspace, Tab, and mouse keys.

For those who are seeking a more radical alternative, there is the $1,000 **DataHand System**, from DataHand Systems. With a unique design, the DataHand keyboard requires you to relearn the wheel in some respects. It has five finger modules; each of these modules represents five keystrokes, and different keystrokes are represented by the direction of motion used to activate the key.

Cirque Corp., Salt Lake City, UT; 800-454-3375, 801-467-1100; http://www.glidepoint.com. *Circle 416 on reader service card.*
DataHand Systems Inc., Scottsdale, AZ; 800-875-7171, 602-860-8584; fax, 602-860-1351. *Circle 417 on reader service card.*

BRIEFS

Books

The VRML Sourcebook, written by a team of programmers from the San Diego Supercomputer Center, is an authoritative guide to creating virtual worlds using the industry-standard VRML (Virtual Reality Modeling Language) ($29.95, John Wiley & Sons, *http://www.wiley.com/compbooks/*) .... Learn how to use clip art effectively to design professional-looking projects, whether they be business presentations or wrapping paper, with ***Clip Art Crazy*** by Chuck Green. An included CD-ROM contains 500 high-quality images ($34.95, Peachpit Press, *http://www.peachpit.com*) .... ***Working in Microsoft Office***, by Ron Mansfield, shows you how to make the world's most popular Windows 95 office suite work for you ($34.95, Osborne McGraw-Hill, *http://www.mcgrawhill.com*).

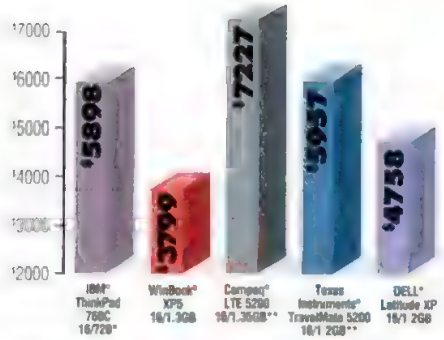
Internet

The Web site of the investment bank **Bankers Trust** includes newsletters and research data produced by the Global Economic Research Group, including a daily U.S. newsletter, a daily European newsletter, reports on the prospects for the credit markets, and a list of key market rates and indexes (*http://www.bankerstrust.com*) .... Do you know somebody who isn't connected to the Internet yet? CRT Multimedia, which is based in the United Kingdom, offers **EasyTutor Get Connected '96**, a $39 CD-ROM packed with comprehensive tutorials on how to get online to both the Internet and commercial services, use e-mail, and surf the Web (*crt@crtmm.demon.co.uk*) .... Another Internet learning tool is Apte's $49.95 **Internet Coach for Netscape Navigator 2.0**, which provides tutorials on the Internet

PENTIUM® CHIP, LITHIUM, 16MB, TFT, $2999.

75MHZ INTEL® PENTIUM® PROCESSOR

intel inside pentium® PROCESSOR



WinBook XP5

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— PC Laptop Magazine, January 1996

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- Designed for Windows 95
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- Intel 120 or 133 MHz Pentium processors
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[illegible] *Average U.S. street price. Monitor not included. **Other capacities available. HP Vectra PCs come with MS-DOS® 6.2 and MS Windows for Workgroups 3.1 or Windows 95 or OS/2 or Windows NT included. First year on-site, 24-hour, next-day service. Second and third year return to dealer. MS-DOS is a U.S. registered trademark and Windows and Windows NT are U.S. trademarks of Microsoft Corporation. Pentium and the Intel Inside logo are U.S. registered trademarks of Intel Corporation. OS/2 is a registered trademark of the International Business Machines Corporation. ©1995 Hewlett Packard Company. PPG425

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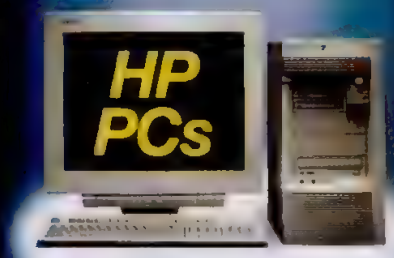

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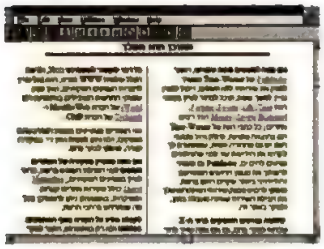


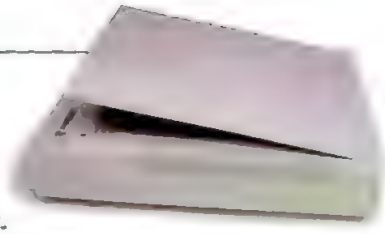
tending its multilingual expertise to the Internet.

The $99 **Internet With An Accent** is a suite of applications that together let you read, write, and publish World Wide Web pages in over 30 languages. Unlike earlier multilingual products, this software is independent of the version of Windows 3.1 or Windows 95 (English, Japanese, or some other language) that you're using.

There are four components: Accent Multilingual Mosaic, which can be used either as a standalone browser or as a browser add-on; Accent Multilingual Publisher, for authoring HTML Web pages that can even include Latin, non-Latin, and bidirectional alphabets in the same document; Accent Multilingual MailPad, for sending and receiving multilingual e-mail; and a multilingual viewer.

Accent Software International Ltd., Exton, PA; 800-535-5256; fax, 800-535-5257; http://www.accentsoft.com. *Circle 414 on reader service card.*

Scanning Wizardry



JOINING THE EVER-GROWing number of companies offering 24-bit scanners at less than $500 is Microtek Lab. The $399 **ScanMaker E3** is a solid flatbed scanner that doesn't sacrifice functionality or expandability.

The ScanMaker E3 is a single-pass, 24-bit, true-color scanner that features optical resolutions up to 300 by 600 dots per inch (dpi), with interpolated resolutions of 2,400 by 2,400 dpi. The linear-array CCD image sensor helps reduce the noise visible on scans. The scan bed is conveniently oversize, measuring 8.5 by 13.5 inches. An Adaptec SCSI card comes bundled with the scanner.

The scanner features a variety of image controls and prescan image-editing capabilities, facilitated by Microtek's ScanWizard software. The ScanMaker E3 also ships with Ulead PhotoImpact 3.0.

You can add a 10-sheet automatic document feeder for $199 or a $299 transparent media adapter for scanning in transparencies or negatives.

Microtek Lab Inc., Redondo Beach, CA; 800-654-4160, 310-297-5000; http://www.microtek.com. *Circle 419 on reader service card.*

Seeing the Light

LOOKING FOR AN INNOVAtive multifunction peripheral? Lumina Office Products' **Lumina 2000** is a $400 device that's based on a plain-paper-fax engine, but it is also a scanner and copier that functions either as a standalone device or in concert with your PC. The unit has a sleek look and a small footprint, which is critical to SOHO environments. The Lumina 2000 connects via the parallel port, is Twain-compliant, and has a 14.4-Kbps modem and a 60-page storage capacity.

Lumina Office Products, Sunnyvale, CA; 800-586-4620, 408-992-1088, ext. 220; fax, 408-992-1090. *Circle 421 on reader service card.*

The Ultimate Sound

ADVANCED GRAVIS COMPUTER TECHNOLOGY IS OFFERING two new wavetable sound cards that together replace the company's UltraSound MAX line of wavetable cards. The $150 **UltraSound Plug & Play** and $200 **UltraSound Plug & Play Pro** include 1MB of ROM, AMD's Interwave chip, full-duplex capabilities for real-time conversation over the Internet, a microphone, and a collection of popular music software and Internet-access tools and utilities. Other features of the UltraSound models are full 16-bit stereo recording and playback at up to 48 kHz and a 192 General MIDI instrument set. The Pro version also has 512K of on-board memory and a 5.6MB General MIDI patch set.

Advanced Gravis Computer Technology Ltd., Burnaby, British Columbia, Canada; 604-431-5020; fax, 604-431-5155. *Circle 418 on reader service card.*

BRIEFS

and on using the latest version of Netscape (800-494-1112).

Hardware

Do you need to print labels, and lots of them, over a network? For $199.95, you can get Seiko Instruments USA's **Network Printer Sharing Kit** for adapting Seiko's Smart Label Printer Pro for use by five users over a network (800-688-0817) .... Epson America is manufacturing the $199 **ZIP 100**, an Iomega-compatible version of Iomega Corp.'s popular Zip drive (310-787-6300) .... Imagelink is offering the $4,699 **Virtual Desk PC**, a complete desktop videoconferencing system that is designed for real-time videoconferencing over the LAN and WAN or over ISDN lines (800-420-1110).

Software

Equis International's investment-analysis and -charting software finally moves to the Windows platform with the $349 **MetaStock 5.1 for Windows** (800-882-3040) .... Datatech Enterprises' **AccuZIP 6** corrects, modifies, and standardizes every address in your database. AccuZIP 6 also adds carrier routes, ZIP +4 codes, and delivery-point bar codes (800-523-0320) .... PictureTel Corp.'s $1,995 **PictureTel LIVE PCS 200** brings PictureTel's videoconferencing add-on kits to Windows 95 (508-762-5000) .... Ashlar Corp.'s $249.95 **Ashlar Drawing Board** is a versatile two-dimensional CAD package for home and small-office users. The Drafting Assistant feature helps you along by anticipating what you're trying to do based on your mouse movements and by extrapolating the necessary geometric properties (800-206-4075).

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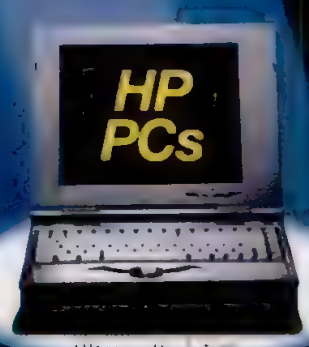

HP OmniBook 5000

*Average U.S. street price. J.D. Power and Associates 1995 Notebook Computer End-User Satisfaction Study, Office Based Businesses. [1] Study conducted among 1,200 business users. [illegible] 366

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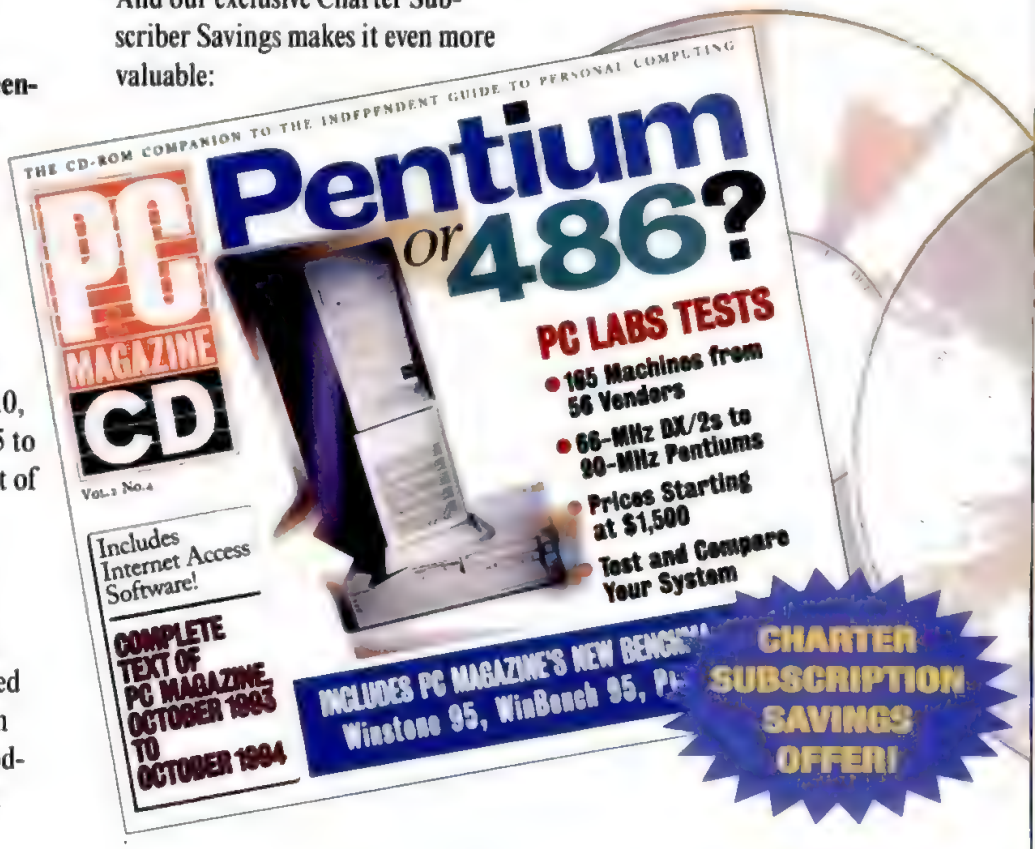

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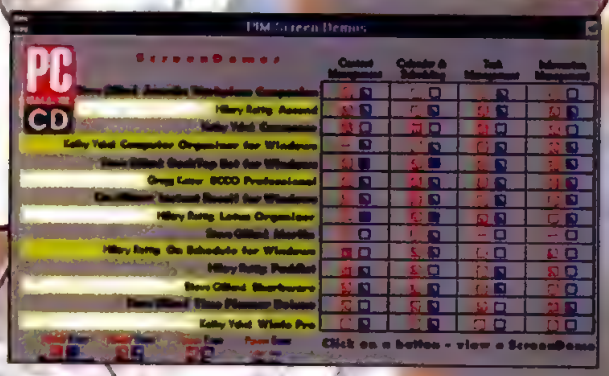

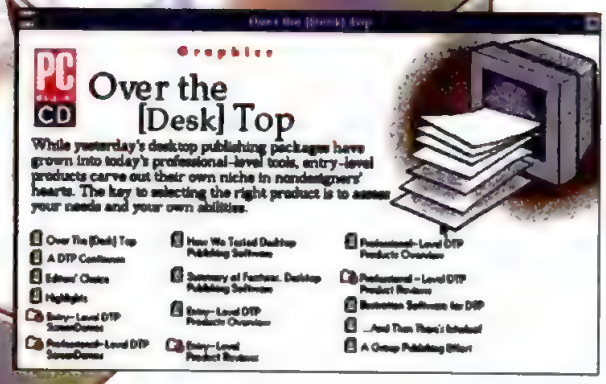

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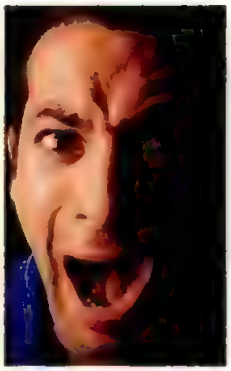

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CIRCLE 021 ON READER SERVICE CARD

Avatarred and Feathered

I've been a fish, a casual dude, a digitized version of myself, and a chess piece in a variety of 3-D worlds. I've chatted with cartoony characters of indeterminate gender and those of unmistakable gender. I've been invited into private rooms and asked to leave them. I've lived in cybercommunities where I could own property, build a house, and create a cozy little world for myself, maybe even raise a couple of cyberkids with a cyberspouse behind a cyberpicket fence.

I've watched animated sprites dance across my screen as mail messages. Little envelopes and folders have flown from one computer to another on my screen to signify file transfers. Clouds billowed, flags waved, music from new-age orchestras wafted its gentle phrases forth.

It's all been very entertaining, and doubtless seductive to the newbies. But couldn't I just have a few of those CPU cycles back to get some real work done? For instance, if I want to do some electronic shopping, why am I increasingly presented with representations of downtown stores or shopping malls? All it does is make me anxious about finding a parking place or running into a bunch of rowdy mallrats.

I've looked at all the 3-D virtual-reality programs around, from chat rooms to shopping malls. Invariably, using them takes longer and is less convenient and direct than simply working in a plain old dialog box, clicking on the thing I want or typing in some search terms. The real 3-D world around us is the only one we've got, and it's pretty chaotic. Why impose that chaos on the inherently orderly world within our computers?

For a while there, interface designers were talking about "modeless" computing and efficiency. Today, it seems that most of those gains have been sacrificed on the altar of entertainment. Software designers are straining so hard to come up with new user-interface metaphors that they tax our patience even as their products clamor for our attention.

I risk sounding like a stuck CD because I know I've said this before, but I can't help it. This one is directed at the interface designers: When someone is using a computer, you have their full attention. It's an active medium. In fact, the computer doesn't do anything unless we tell it to. So why do you want my screen to resemble a three-ring circus?

Less is more when it comes to user interfaces, amply proven by truly excellent products such as Kai's Power Tools. KPT creator Kai Krause won a *PC Magazine* Technical Excellence Award a decade ago for his work in 3-D graphics. Since then, he's made magnificent strides, not only in the sheer power of his tools but in the elegance of his approach to user interfaces. In many of his products, interfaces simply disappear when not needed, yet the pieces you need magically reappear with a mouse click or a slide to one side of the screen.

IN YOUR FACE

The real world is chaotic enough. Why impose that chaos on the orderly world in our PCs?

Compare that with the encrustation of buttons, rulers, and doodads that surround your word processor's active display area. You can do the full-screen trick to make all that junk go away, but the software isn't really designed to get out of your way and return gracefully. Full-screen mode is strictly for people who know the finger macros.

In an opposite but related vein, Windows 95 looks much cleaner than its predecessor because it hides everything behind the Start button. It takes longer, however, to launch your applications, unless you litter your screen with shortcut buttons. Is this progress? No, it's like those avatars and mall metaphors—a layer of complexity and sophistry that impedes your real task; pretty feathers that hide the real meat.

Avatars in 3-D worlds will probably achieve significant success among teenage chatters. Many of them don't know or don't like who they are, and it gives them comfort to pretend to be someone else, to try on identities and attitudes. Part of the game is to see how outrageously they can lie and still get away with it: before a schoolmate recognizes their ID, or a resident of the town or country they're claiming to be from trips them up with questions they can't answer. Teen chat is quite different from adult fantasy MOOs and MUDs, where you're a participant in an ongoing novel and suspension of disbelief is inherent. Many teenagers are self-appointed ugly ducklings, yearning for their adult plumage. Through avatars, they get to try on all those different colors and markings.

Feathers look great on birds. They look pretty stupid on anything else. □

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CIRCLE 203 ON READER SERVICE CARD

The I-Way Is No Road to Riches

Okay, I admit it: I have a conflict of interest. I want to make money, and I'm being stifled because a system that was promised now looks as if it may never materialize. My conflict of interest involves the notion of writers getting paid by the "hit" on the World Wide Web—not, as is the case with print publications, by the word or the column. This is where the conflict of interest comes in. Being a competitive guy, I'd love to go out there, word processor in hand, and start slinging mud. The more provocative the column, the more hits the site would receive and the more money I'd make. Wouldn't that be cool?

The trouble is that this model requires some sort of accepted cybercash system, a development that has so far eluded the Web and may never happen if the Internet continues on its current course. People have come to expect something for nothing on the Web, and publishers of online content have turned to advertising rather than imposing user fees. In other words, the only difference between a typical magazine on newsstands and the Web magazine of the future will be the delivery mechanism. That stinks, and not just because I won't be getting rich.

With that personal gripe out of the way, let's look at the issues surrounding the idea of making money on the Web. There are three possibilities: (1) Use the magazine model and sell loads of advertising, (2) charge subscriptions, and (3) charge a cybercash fee for viewing pages. There is also potential for a combination of the three, but nobody cares about that.

The advertising model requires new methods for auditing readers. With the right technology, the Web could improve on the print magazine model. Print magazines usually charge for advertising based on circulation, with certain premiums for preferred placement (facing a Dvorak column, for example). Web publishers could vary rates based on the actual number of people who visit a particular Web site. What exactly is the best way to gauge this traffic is still a matter of debate, but you can bet it's being worked on. In addition, there is the potential for targeting ads, based on your personal profile. You would receive only advertising you might actually be interested in. This would also benefit consumers by allowing smaller, specialty companies to play in the big, mass-market sandbox. The downside is a perceived loss of privacy.

CASHING OUT

Cybercash lacks the lure of both free e-zines and all-you-can-eat subscription-based services.

The subscription model, on the other hand, is probably the simplest, but it requires a specialized product with information that people will pay for. I believe the typical Web version of a magazine will probably not attract subscriptions unless it's some weird porn thing. Web magazines are ethereal and will probably always be free. Real magazines still have to be printed, and this costs money, which is usually offset by subscriptions. While subscription models with flat monthly charges always sound great, they assume like an all-you-can-eat restaurant that you're not really going to get your money's worth. If you do get your money's worth, they will raise the price. Online services that will thrive on subscriptions will be mostly large, comprehensive commercial services such as AOL or products such as Stanford University's Electronic Library, which helps researchers and students sift through heaps of information.

But the pay-as-you-go cybercash model might also work if the price is right. For example, let's say you pay $3 for a 300-page computer magazine. Would you be willing to pay 1 cent per page of that magazine if you knew you would be interested in only 10 to 20 pages at most? In other words, you would pay only for what you want. The problem with the cybercash model is that it has no attractive hook. It lacks both the lure of free e-zines and the appeal of the all-you-can-eat subscription-based services.

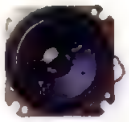
This is bad news for people like me who were hoping to cash in on cybercash. When I first heard the concept of penny-a-hit fees on the Web, I thought it was a cool idea and technologically feasible. Now, I realize I must have been temporarily dazed and confused. Cybercash may turn out to be nothing more than a means of collecting subscription fees and paying for T-shirts and CDs purchased online. Unless some marketing genius comes along soon to sell it to the world, I'm afraid that the Web of the future will be cluttered with advertising much like the billboards that blight the landscape. So much for early retirement.

SHOPPING FOR A 17" MONITOR?

ENJOY THESE FABULOUS SAVINGS.

"If you stare into only one 17-inch screen this year, let it be Nokia's...," said the editors of *Home Office Computing*. Excellent advice, if you want to rub your eyes in astonishment – not irritation.

Even at first glance, Nokia 17" monitors stand out (actual viewing area 15.63"). Whether it's the Nokia 447X professional caliber display, the Valuegraph 447L with built-in speakers, or the ***new*** multimedia 447W you'll enjoy unparalleled clarity.* At their maximum refresh rates, they can render images of near photographic stability.



Nokia makes speakers for German luxury cars, so adding them to monitors was easy.

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Refresh Rates	640x480	800x600	1024x768	1152x870	1280x1024	1600x1200
447L 17"	100Hz	100Hz	80Hz			
447W 17"	100Hz	100Hz	100Hz	90Hz	70Hz	
447X 17"	110Hz	110Hz	100Hz	90Hz	76Hz	65Hz

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Inside Track

The Big Switcheroo Dept.: There's been a lot of talk about the **new multimedia extensions (MMX)** to be added to the Intel P55C Pentium chip. What everyone is not telling you is that **all the Pentiums** may well incorporate the MMX circuitry by the end of the year. These are not trivial changes, according to an anonymous phone call I received regarding the new chips. Take what I'm about to tell you as **unconfirmed—but highly likely—rumor,** not fact.

MMX will be the standard, period. It will revolutionize multimedia and could even jeopardize the future of graphics and video add-ons such as accelerator cards and MPEG-II chips for PCs.

MMX is Intel's latest scheme to pull the rug out from under the competition. Although it did recently license the MMX instruction set to AMD, I believe this was a slap at Cyrix, which was arrogantly hoping to popularize its own multimedia code. **MMX will be the standard, period.**

The MMX extensions will at minimum allow for **full-screen 640-by-480, 16-million-color, 30-frame-per-second** video without MPEG compression. This is raw processing. It also has room for a simultaneous 44-MHz digital audio channel. If all this is accurate, MMX will revolutionize multimedia and could even jeopardize the future of graphics and video add-ons such as accelerator cards and dedicated MPEG-II chips for PCs. I'm told some 166-MHz test versions of these chips are floating around.

The instruction set of the chip was given to developers in March. It's believed that when the chip becomes official, **200 MHz** will be the clock speed of the low-end version. There is some confusion regarding this, since I doubt Intel is going to discontinue the 100-, 133-, and 166-MHz Pentium CPUs, and supposedly the company is going to **slipstream the MMX circuitry into all Pentiums** sometime during the **summer.** This includes the Pentium Pro. The **code name** for the Pentium Pro MMX is **Klamath,** and it's one of Intel's best-kept secrets. (Intel is starting to use code names nowadays instead of numbers. The P7 is the **Merced**, for example.)

These MMX extensions have been **downplayed** in the press, because Intel is **worried sick** that people will stop buying computers and wait for this change. I'd be worried, too, since this upgrade seems more important than floating-point circuitry, especially because it also includes **a slew of powerful 3-D instructions**. Curiously, industry publications, which may be under nondisclosure agreements on the Intel stratagem, are now doing articles such as "PC Graphics Reach New Level: 3D/PCs Will Become a Compelling Platform for 3D Applications in 1996" (*Microprocessor Report*, January 22, 1996). Curious timing. And the MMX is **never mentioned** in the article, though it's touched upon elsewhere. You have to read between the lines nowadays. (Companies use the nondisclosure agreement not to keep secrets away from competitors but to keep information out of the hands of the public. I don't sign them.)

The fallback for people who buy the last of the "old" Pentiums will be an **MMX OverDrive chip**—it will incorporate a **step-down transformer,** since the new chips are all 2.9-volt (which allows them to be used in laptops immediately). Intel is going to have to price this OverDrive unit dirt cheap to keep buyers from simply waiting for MMX chips and **creating a glut of "old" Pentiums**. Expect to see **prices lowered** at a faster and faster pace as the slipstream change nears.

Now Everything Makes Sense Dept.: If you recall, a lot of **weird deals** have been made recently. One between **Sony and Intel** was particularly unusual, because the companies were **giddy for no apparent reason.** The reason now seems to be this MMX chip. Sony plans to roll out an MMX machine incorporating the new **high-capacity DVD disk.** It will have the attributes of the most full-blown multimedia machine and will probably have Sony PlayStation characteristics. An MMX machine with a DVD will be the machine to copy next year.

These MMX changes also explain some of **the chitchat recently about NSP** (native signal processing), which will be done on board the chip rather than with a DSP. Intel has always been **embarrassed** by the fact that the PowerPC, with its powerful floating point, could do **impressive** native signal processing far better than any Pentium. In fact, the earlier Intel announcement about NSP was actually a "coded" **crypto-comment** signaling developers to start thinking along these lines because something is going to change.

So What About the PowerPC? Dept.: As a final aside, I'm told that Adobe Photoshop should run **four times faster** on an MMX-empowered chip. Currently, Adobe Photoshop runs twice as fast on a PowerPC than on a Pentium running at the same clock speed, thus keeping the Macintosh alive and healthy. The failure of the PowerPC 620 to get launched on time and its reported **crummy performance,** combined with Intel's aggressiveness, may well turn the Intel-based PC into the graphics community's machine of choice (which it currently is *not*). This large market is a target of both Intel and Microsoft, and the MMX extensions may finally bring it within their grasp. The PowerPC may be **the real target** of this entire change. It's a big risk to make a radical change like this, but the results will be **increased Intel dominance.** Are these guys something, or what? □

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Dum-Da-Dum-Da-Dum-Da-Dum...

Remember the tag line they used when *Jaws 2* came out in 1978: "Just when you thought it was safe to go back in the water. . . ."? PC users are going to face something like that this year. In 1995, many of us faced the wrenching decision to move to Windows 95, or maybe OS/2 Warp, or even Windows NT Workstation. And at least several million of us then faced the consequences of actually *making* that move. So we ought to be set, right? No big issues about changing very soon again, eh?

Ha. Even if you made The Big Switch last year, you're going to be assaulted—and, I suspect, strongly tempted—this year by a barrage of ads and inducements to change yet again. And guess what? For a lot of us—you tell me whether this is the good news or the bad news—it's going to make sense to switch. Again. Already.

First, rest easy: No, Microsoft insists, there's no such thing as Windows 96, a major new release of its mainstream product, waiting in the wings this year. A few additions, yes: a service pack, already released, with an accumulation of new drivers and a few nice touches such as ISDN support. A few gee-gaws, such as the Power Toys toolkit you can download free from Microsoft's Web page (*http://www.microsoft.com*). Version 2 of Microsoft's Internet Explorer is already in use, and Version 3 is coming sometime in the third quarter.

But no major release is forthcoming. Microsoft executives say they're not embarrassed about selling a product named after last year. And some say they think the notion that the product you're buying has been on the market a year or more may actually help sales: Buyers will trust what seems to be an established product.

CHOICES, CHOICES

Guess what? For a lot of us, it's going to make sense to switch operating systems. Again.

No, the big noise from Microsoft this year is going to be Windows NT Workstation when the so-called "NT-SUR," or Windows NT Shell Update Release, comes along in a few months. Windows NT Workstation 3.5 and especially 3.51 won a lot of friends for Microsoft last year, when many corporate IS managers were not very happy with the idea of a Windows 95–based future.

But Windows NT Workstation (as distinct from the Windows NT Server product, which is doing very well nibbling away NetWare's installed base and even replacing some Unix servers) had major problems. For a long time there was no PCMCIA support, which kept it off notebooks; then it got PCMCIA support but only of the feeblest nature. It didn't have the benefit of the more-or-less-object-oriented Windows 95 user interface. And it didn't have Plug and Play capabilities.

Most damningly, in a world still being told that Windows 95 runs fine in 4MB of RAM, Windows NT Workstation 3.5 and 3.51 needed 16MB to get off the ground and 32MB to perform acceptably. Sure, Windows 95 is a memory hog, and yes, of course, it's awful in 4MB of RAM. But it works pretty well with 8MB and takes off with 16MB. With memory hovering around $40 per megabyte last year, were 32MB desktops—boxes with more than $1,200 worth of memory in them—defensible?

Corporate America hemmed, hawed, and punted, staying with Windows 3.1 or moving to Windows 95, knowing it was only an interim step.

But it's 1996 now. Memory prices are dropping. And just as PC buyers once accustomed to 640KB and then to 1MB machines in the DOS era finally got used to the idea of 4MB, then to 8MB, then to 16MB Windows boxes, they're now getting more comfortable with the idea of the brave new world of 32MB.

Better still is that, with the mid-1996 Shell Update release of Windows NT Workstation, they get a stable, powerful, security-conscious operating system. With the Windows 95 interface and the stack of 32-bit Windows 95/NT applications that have appeared since last August's rollout of Windows 95, Microsoft's theme for this year—carefully crafted by the folks in Redmond and their PR spin doctors and polished to near perfection—is that 32-bit-ness is really what it's all about. Doesn't matter all that much whether it's Windows 95 or NT; have it your way. And would you like fries with that?

Microsoft says it's perfectly happy to put either Windows 95 or NT on your desktop. Or notebook, for that matter. After all, the subtext of these conversations goes, Microsoft makes money either way. As long as you make the 32-bit move. Now.

At the beginning of 1996, Microsoft quietly modified its

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corporate-licensing agreements to underscore this perspective. Once, licenses specified either Windows 3.*x*, Windows 95, or Windows NT Workstation. Now, buyers can get both Windows 95 *and* NT Workstation for one price. You can move first to Windows 95, then to NT—or make the jump directly to NT. For $250, the choice of operating system is yours. As long as it says "Microsoft" on the box.

Over time, Windows 95 and its successors will become, in Microsoft's scheme, the consumer operating system, ideal for home PCs and multimedia. Windows NT Workstation rules at the office. And one big, happy family of 32-bit applications works with either.

It's easy to be cynical about world-domination plots from Redmond, and I often *am* cynical about Microsoft's maneuvers. But this Microsoft plot makes a lot of sense, and not just for Microsoft shareholders. Windows 95 is full of things—AutoPlay for CDs and PnP upgrading come immediately to mind—that are ideal for home PC users. And Windows NT Workstation is a robust, secure system designed from the ground up for businesses' needs.

Which is why I think a lot of *PC Magazine* readers are going to be sorely tempted this year to change OSes again: to Windows NT Workstation, in early summer.

If you just moved to Windows 95, don't despair. I often suggest that corporate PC shops first install Windows 95 on non-standard-configuration machines (to let PnP work out some of the kinks), then when everything's working right, put Windows NT on the box.

And *you don't need to change*—to Windows NT or anything else—*if you like what you've got.* My colleague Bill Howard likes to kid me about that line, which is something of a mantra of mine: He recalls that I've said it more than once in these pages over the past decade. But it's true: Windows 95 machines run fine on less memory than Windows NT boxes. And especially for users of the current generation of notebook PCs, Windows 95 will still make more sense, because you need less memory. Don't forget that Windows 95 is a very good network client, for both Windows NT Server or NetWare. And it costs a third as much as Windows NT.

That said, don't be surprised if you find yourself drawn between the Scylla of Windows 95 and the Charybdis of Windows NT. I am, a lot of my corporate clients are, and I think you will be, too.

Just when you thought it was safe to go in the water again.... □

A Scanner on Every Desk

According to a proverb, the person who has everything has nothing. That is certainly the case when it comes to those of us who collect seemingly anything ever printed and file it never to be seen again. Enter personal scanning. With a scanner, you can store reams of documents without taking up any physical space, retrieve information more easily, and hold onto all those documents that should've been sent to you electronically. Personal scanning involves anything that is somehow important to you, ranging from newspaper and magazine clippings to Dilbert cartoons and receipts. You either use the information yourself or share it among your workgroup. Business scanning, in contrast, is used to save information such as invoices or expense reports or to archive documents that will be widely distributed.

Several new technologies have made the widespread use of scanners possible. Nowadays, there are lots of cheap storage options—from big hard disks, now standard in most PCs, to removable mass-storage devices from Iomega, Syquest, and others. And less expensive big-screen monitors let you display legible thumbnail images of scans.

There's no doubt that personal scanning is hot. HP sells the popular Visioneer PaperPort Vx scanner as the ScanJet 4 (Visioneer's version is slightly better), and Compaq has integrated scanners into some of its PC keyboards. HP will soon include a small color scanner in the drive bay of some Pavilion home PCs.

Here's what I've found about personal scanning:

• It's highly addictive. I've become accustomed to scanning in just about anything I might refer to again. For instance, every time Intel mails out its quarterly CPU pricing, I scan in the sheet. I'm sure Intel created the price sheet using a spreadsheet or word processor, but that's not how Intel sends it to *PC Magazine*.

• It's one of those useful dual-purpose business/personal technologies. Once you acquire the scanner for business use, you'll find personal uses as well. Keeping the last few months' utility and credit card bills as scanned images on your laptop is helpful in case you need to do telephone battle with the cable company during the workday or while you're traveling. I've scanned in the how-to booklets for my LCD wristwatch and the summary sheets for my cellular phone and home answering machine. I scan most things at low res (200 dots per inch), saving higher res (400 dpi) for small documents with tiny type or images I know I'll need to reproduce. In six months I'm up to 50MB of material, but most people probably wouldn't get beyond 10MB a year. Scanning this page of *PC Magazine* consumes 60K to 120K, depending on resolution; as a text-only ASCII document, it would be 5K.

FROM PAPER TO PC

Scanning is highly addictive. I scan in just about anything I might refer to again.

• The OCR software (bundled with most personal scanners) is okay for text conversion, but I don't trust numeral conversion, except when using highest-quality originals. Your eye or your spell-checker can figure out *buslness* means *business*, but it hasn't a clue that what the scanner recognizes as $24.55 is actually $74.55. I'm still waiting for business-card scanning software that really works. Every six months it gets a little better. Regardless, I do scan in business cards, but I save the bitmap images in case the phone number translated wrong (possible) or the Internet address was incorrect (likely). You can store about 125 business cards per megabyte.

• Most personal scanners are monochrome, and what the world needs is color. I use two scanners: the PaperPort Vx ($299 list price; 800-787-7007) for scanning monochrome documents and business cards (it includes CardScan Plus business card OCR software) and a flatbed Canon Computer Systems IX-4025 ($699 list price; 800-848-4123) for bound documents and color scans. HP's ScanJet 4C flatbed does an even better job, but it's a lot more expensive ($995 list price). Home-oriented users who need personal color scanning might want to consider the Visioneer-like $399 Logitech Page Scan Color (reviewed in First Looks, January 23, 1996).

Finally, don't forget that when you have a home scanner, you also have the front end of a fax machine (using your PC's fax modem) and a medium-res personal photocopier (using your printer). Note also the intra-company synergy: The more you scan, the more ink cartridges and paper you'll likely use. Canon is the leader here, followed by HP, in bundling software with its scanners and printers that lets you create greeting cards, posters, and even T-shirt transfers. □

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Hard Drive	720MB	720MB	510MB (removable)	810MB (removable)
Cache	16KB Internal	16KB Internal	256KB, 64-Bit	256KB, 64-Bit
Diskette Drive	Internal 3.5" 1.44MB	Internal 3.5" 1.44MB	Modular 3.5" 1.44MB	Modular 3.5" 1.44MB
Display	10.4" Color Dual Scan	10.4" Color TFT	10.4" Color Dual Scan	10.4" (800x600) CTFT
Video Graphics	32-Bit Local Bus	32-Bit Local Bus	32-Bit PCI Local Bus 1MB VRAM	32-Bit PCI Local Bus 1MB VRAM
PCMCIA Slots	2 Type II	2 Type II	2 Type II	2 Type II
16-Bit Audio	No	No	Yes	Yes
Internal CD-ROM Drive	N/A	N/A	Optional QuadSpeed	Optional QuadSpeed
Pointing Device	Optical Trackball	Optical Trackball	EasyPoint™ II	EasyPoint II
NiMH Battery	3-5 Hours	3-5 Hours	2-4 Hours	2-4 Hours
Ports	Keyboard/Pointing Device, Enhanced Parallel, Serial, External SVGA	Keyboard/Pointing Device, Enhanced Parallel, Serial, External SVGA	External Keyboard/ Pointing Device, Headphone/Speakers, Microphone, Infrared Communication, External SVGA	External Keyboard/ Pointing Device, Headphone/Speakers, Microphone, Infrared Communication, External SVGA
Software	MS-Windows® 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1; MS-Video for Windows, Compaq Sound System	MS-Windows 95 or MS-Windows 3.1; MS-Video for Windows, Compaq Sound System
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Hard Drive	630MB or 1GB	630MB or 1GB	1.2GB or 2GB	1.2GB or 2GB
Cache Internal	16KB	16KB	16KB	16KB
Cache External	256KB (optional)	256KB (optional)	256KB	256KB
Architecture	PCI	PCI	TriFlex/PCI	TriFlex/PCI
Video Memory/Max.	1MB/2MB	1MB/2MB	1MB/2MB	1MB/2MB
Compaq 150 Color Monitor	Yes	Yes	Yes	Yes
Diskette Drive	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB	3.5" 1.44MB
Expansion Slots (Total)	3	3	5	5
Drive Bays (Total)	3	3	5	5
Ports: Serial/Parallel	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)	1/1 (ECP)
Security Features	Yes	Yes	Yes	Yes
Processor Upgradable	Yes	Yes	Yes	Yes
101-Key Keyboard, Mouse	Yes	Yes	Yes	Yes
Software Preinstalled (Choice of)	MS-Windows® 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1	MS-Windows 95 or MS-Windows 3.1
Energy Star Compliant	Yes	Yes	Yes	Yes
Limited Warranty*	3-Year	3-Year	3-Year	3-Year
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NETWORK EDITION

ISDN REMOTE ACCESS

LAN on Demand

New ISDN products provide seamless, secure LAN remote access without the hassles that plagued their predecessors.

ILLUSTRATION BY FERRUCCIO SARDELLA

By Les Freed

If you need to connect a few remote PCs to your IPX-based LAN, we have a pleasant surprise for you. There's a new generation of ISDN remote-access products that can pave the way. These routers are similar to their leased-line relatives, except that they use an ISDN line in place of a more expensive—and less flexible—dedicated point-to-point leased line. And they're much better behaved than before.

INSIDE

PC MAGAZINE

You're not just imagining things. If it seems as if the Internet plays a part in everything you hear about and do, that's because it does. Take the ISDN remote-access devices reviewed in this issue's cover story.

REVIEWER LES FREED found these products much improved over most other ISDN devices we've seen—even those we've reviewed in recent months. Clearly, the advances for ISDN—in terms of both easier-to-use products and better hookup procedures—are in good part the result of an enormous demand for faster, better connections to the Internet. ISPs have increased the number of ISDN lines they make available, and they need quality products in the hands of users. ISDN product vendors, pushed for better products, are responding.

IN FIRST LOOKS, contributing editor Steve Rigney gives us a look at recent network management releases from Intel. Here it's the NOS comer Windows NT Server that's busting wide open the market for third-party products. With its LANDesk Management Suite, Intel offers you an alternative to Microsoft SMS for monitoring your NT servers. But more important, LANDesk monitors your NetWare servers from the same package—an important point to countless administrators, but something that SMS doesn't do. (Page NE27.)

RIGNEY ALSO PUTS the latest addition from Artisoft through its paces. LANtastic for Windows 95 continues Artisoft's tradition of making "every client" welcome on a network. LANtastic for Windows 95 builds on the network features of Windows 95 by inviting all your non-Microsoft clients into your small-business network. If your DOS, OS/2, and Macintosh clients are still viable without a change to Windows 95, then you still need a separate NOS like LANtastic to connect them. (Page NE27.)

—Gail Shaffer

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ISDN routers provide an on-demand link between two points. You can use them to connect multiple LANs on an as-needed basis, or you can connect smaller branch-office LANs and even single-workstation, work-at-home users.

For this article, we took a close look at several remote-access products, focusing on those suitable for the small-office and home-office market: Ascend Communications' MAX 4000 and Pipeline 25 ISDN Router, Gandalf Technologies' XpressStack BRI and XpressConnect LANline 5242i, and Symplex Communications Corp.'s DirectRoute DR-1 and DirectRoute Remote RO-1. The Ascend solution will also work for larger installations.

ISDN MAKES HEADWAY

ISDN remote-access products have come a very long way in a very short time. Early ISDN remote-access products had a well-deserved reputation for being difficult to configure. Not surprisingly, all of this progress is in part the result of the remarkably rapid growth in popularity of the Internet, which created a huge demand for faster, easier-to-use routing products.

Internet service providers, for example, are clamoring for flexible, easily configurable routers to get their customers connected. In response to all of this demand, Ascend, Gandalf, 3Com, and other companies have developed relatively user-friendly ISDN routers. Interestingly, it's an IP trend that has benefited the IPX world.

The new Internet routers' first cousins, the products we tested here for the remote site, are equally easy to use. They can be used to route Internet IP traffic as well as NetWare IPX traffic, so you give your remote users a much faster route for connecting to the corporate LAN. And once installed, they provide a nearly seamless link between the remote PC and the host LAN.

The solutions we tested provide remote Ethernet connections over *basic rate interface* (BRI) ISDN lines. They each consist of a host unit and one or more client units. The host-side unit connects directly to the main-office LAN and to one or more ISDN lines, providing access for two remote users per BRI line. All of the host-side units we tested support multiple BRI connections: the Ascend and Gandalf each have eight ports, and the Symplex unit has four. Ascend also supports PRI links.

The client-side units are modem-size boxes, each with an ISDN-line interface and a 10Base-T Ethernet connector. The client router's 10Base-T connection provides a single Ethernet port, but you can connect the client router to an Ethernet hub to provide multiple ports to service several PCs.

These products require no additional software at either end of the connection, and they make no resource demands on the host LAN, the file server, or the client PC. The remote PC needs an Ethernet NIC and the appropriate LAN driver software—just as it would if it were connected directly to the main office LAN. (See the related sidebar "Who Needs Ethernet Anyway?" for products that connect differently.)

AS YOU LIKE IT

These ISDN remote-access units have a lot that recommends them beyond ease of use. First, they're enormously cost-effective when compared with dedicated lines, which are very expensive. Programmed to dial up the main office automatically when they detect outbound LAN traffic, these products will also disconnect the ISDN line—saving time charges—when LAN traffic drops to zero for a predetermined period of time. All three products use a technique called *protocol spoofing* to prevent the constant server and router broadcast messages from bringing up the link.

In addition, the host-side routers are not limited to ISDN clients. All three vendors offer a choice of connectivity options ranging from analog lines (Ascend offers built-in V.34 modem modules) to T1 leased lines, letting you mix and match media to meet your company's needs.

An extra bonus for SOHO installations is voice service. One of ISDN's big attractions is that it provides two channels per line. Either channel can be used for voice or data traffic. Two vendors here, Ascend and Gandalf, provide an analog voice port on the remote unit. This allows you to maximize your use of the ISDN phone line by opening it up for voice calls.

JUST LIKE THE REAL THING

Our testing showed that these products are surprisingly fast and flexible. All of the products here can work as routers; we tested them, however, as IPX bridges, because bridging is typically more efficient when there are a very small number of client PCs at the remote site. Our test-bed setup had only a single client PC on the remote side.

We found all three units fairly easy to

XpressStack BRI, XpressConnect LANline 5242i

These two products from Gandalf Technologies are impressive. They're easy to use, and they scored highest in our performance testing. But that's only half the story. Gandalf pays close attention to details. The status LEDs on the XpressStack host-site router are a nice touch and a useful troubleshooting tool, and they're on the front panel where you can actually see them. We also liked the XpressStack's eight-port configuration. It's just the right size for small-business and departmental LAN access.

PC MAGAZINE NETWORK EDITION EDITORS' CHOICE

The 5242i remote unit has its share of convenient features too—a quick-connect button, excellent analog voice support, and a hefty metal cabinet that is well shielded against RF emissions.

We liked Symplex's ease of configuration and low price tag. If you can live without voice support for your client units, it's a fine product that's easy both to configure and to use.

Ascend Communications' duo might have walked away with our Editors' Choice if it didn't have such a high price tag. Ascend's MAX 4000 supports many more clients than the Gandalf and Symplex products. Used with PRI lines, the MAX's price per port is in line with the competition's. So if you need to start big and grow bigger, the MAX 4000 could be the right choice. We'll keep a close eye on its smaller brother—the MAX 1800—for our next review of these products.

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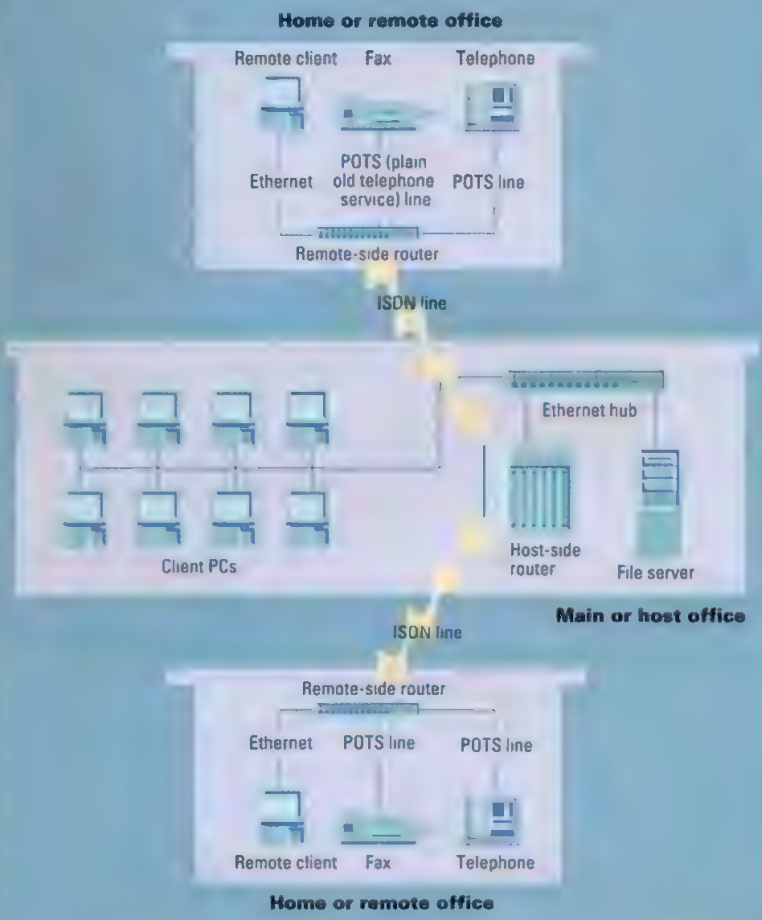
Your Ethernet Extension Cord: Connecting Remote Users via ISDN

You can think of ISDN remote-access products as your Ethernet extension cord: They allow several small offices or work-at-home users to connect to the main-office LAN at the same time. Remote users see all shared resources on the main LAN as they would if they were sitting at PCs in the office, and often just as quickly. The ISDN line provides a 128-Kbps connection, and data compression can boost that speed to over 500 Kbps.



Two of the products we tested let you use the ISDN line for voice and fax traffic, eliminating the need for separate voice and fax lines at the remote sites

set up and configure. Typically, you connect the LAN and ISDN lines, then configure the router through a terminal attached to the router's serial port. If you're running TCP/IP on your LAN, you can link to the routers from the LAN via telnet—but you'll still need a terminal to perform the initial setup.

The Ascend and Gandalf host-side routers communicate using both Point-to-Point Protocol (PPP) and Multilink PPP, which are industry-standard protocols. This means that—with the proper client software—you can concurrently use several vendors' client-side products to connect to one host LAN.

We were able to connect to the Ascend and Gandalf routers with a Motorola BitSurfr Pro using Microsoft Windows 95's built-in dial-up networking facility. Though the Symplex product used a proprietary protocol at the time we tested, the company says that it is working on PPP and Multilink PPP options for its routers.

All three products provide data-compression to maximize the throughput on the ISDN line. Ascend uses the Stac data-compression coprocessor, and Symplex uses a proprietary data-compression scheme. Gandalf hedges its bets by using both Stac's and a proprietary compression scheme. The approach works well: Gandalf's products led Ascend's and Symplex's on our File Throughput test for all three file types.

Good data compression—combined with ISDN's fast call-setup times—means that your remote users may not even feel that they're remote. ISDN remote-access routers could be the key to stepping up your remote users' productivity.

Ascend Communications Inc.

MAX 4000, Pipeline 25 ISDN Router

ALL REVIEWS BY LES FREED

You may not realize it, but you've probably used an Ascend Communications product already. Many Internet service providers use the company's MAX-series routers to connect their dial-up ISDN customers. Ascend's expertise in routing is evident in the quality of the MAX 4000 and Pipeline 25 ISDN Router. Together, they provide a fast, seamless remote connection with minimal configuration hassles.

Ascend calls the MAX 4000 a *network access switch,* but you can think of it as a flexible router, bridge, and terminal server, all in one compact cabinet. The MAX 4000 can route IP and IPX protocols and can bridge any other protocol. It provides PPP, Multilink PPP, and SLIP access to IP or IPX networks.

In addition to ISDN lines, the MAX 4000 can work with analog lines, T1 lines, or a combination of the three. This flexibility accounts in part for the box's $18,500 list price: The device comes with an Ethernet interface, four T1 ports, and a V.35 high-speed synchronous serial port. The T1 ports double as ISDN PRI ports. Because our test-bed uses ISDN BRI service, our test unit was equipped with an optional, $4,500 eight-line BRI interface.

The MAX 4000 has six expansion slots. Ascend offers a variety of expansion modules, including an eight-line V.32bis and V.34 modem module and a six-port V.35 module. The MAX 4000 also comes with a data-compression coprocessor from Stac Electronics. Stac has just incorporated its highly regarded compression software into a chip, and Ascend is one of the first data communication companies to take advantage of it.

The software included with the MAX

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The ISDN You May Not Know

By Les Freed

ISDN has been on the scene for nearly ten years, but its slow adoption has meant that it remains a mystery to many. Although most of you know that ISDN is a digital service that provides faster throughput than a modem, beyond that the definitions get much fuzzier. To keep you at the bleeding edge of this technology, we've compiled a list of the top ten things you should know about ISDN.

1 **You may have heard** that ISDN is difficult to order, that your ISDN equipment must be carefully configured to work with the phone company's switch, and that the whole thing is generally a pain in the neck to set up. This was true up until about a year ago, when the local phone companies and equipment makers finally began to get their acts together. Ordering ISDN is now fairly simple. Most telcos now have special ISDN ordering lines, and most equipment is flexible enough to operate on virtually any ISDN line.

2 **There are two types** of ISDN lines. The first type, a *basic rate interface* (BRI) line, provides three data channels. The two B (for *bearer*) channels are typically 64-Kbps, but in some places they run at 56 Kbps because of limitations of the phone company switch. The D (for *data*) channel carries call-setup and signaling data at 16 Kbps between your ISDN device and the phone company, and it is not normally used for anything else.

The second type of ISDN line, a *primary rate interface* (PRI) line—also called a channelized T1 line—provides 23 B channels and one D channel. In most places, one PRI line is much cheaper than 11½ BRI lines. If you need a large number of ISDN lines in one place, PRI is the way to go.

3 **Each B channel operates** independently of the other and can carry voice or data. On a BRI line, you can place two separate calls to two different locations at the same time, and in most places each B channel can have its own phone number. This means that your remote-office computer can be talking to the office LAN on one B channel while you're having a voice conversation on the other.

There is no interference between the two channels. Your voice call doesn't slow down the data transfer, and in turn, the data transfer doesn't interfere with your voice call. ISDN terminal equipment can tell the difference between an incoming voice call and an incoming data call, so voice calls ring your phone but data calls are automatically answered by the computer.

4 **If you need to,** you can combine the bandwidth of both B channels to get 128-Kbps data throughput. Keep in mind, though, that if you go this route you cannot talk on the phone at the same time. Some ISDN units offer a feature called *bandwidth-on-demand* (BOND), which allows you to use 128 Kbps for data until you pick up the phone. When you begin a voice call, the bandwidth will drop to 64 Kbps for the duration of the call. Standards for BOND are still evolving, but virtually all vendors are working toward a standard protocol.

5 **Many people still believe** that ISDN phones can call only other ISDN phones. This was true once, but now you can call any voice telephone anywhere in the world from any ISDN telephone and vice versa. ISDN voice calls are startlingly clear, especially on long-distance calls. When you call ISDN-to-ISDN, the voice quality is so good that it's almost spooky.

6 **Local utility rates vary** widely, but in many places one ISDN line costs the same as or less than two analog phone lines. Some phone companies charge by the minute for ISDN usage, some charge only for data calls, and some offer unlimited calling. Check with your local phone company or your state's public utilities commission for the rates in your area. ISDN long-distance rates are usually the same as those for normal analog calls.

7 **There's bad news and** good news about ISDN. The bad news first: You can't plug analog telephones, fax machines, modems, or answering machines directly into an ISDN line. Even worse, ISDN telephones are horribly expensive, and we've never even heard of an ISDN answering machine. Now for the good news: Most ISDN routers and terminal adapters include one or two RJ-11 analog telephone jacks. The terminal adapter generates a dial tone when you pick up the line, and it converts Touch-tone signals into the equivalent ISDN dialing codes. So you can keep your old office equipment after all.

8 **Analog telephone lines work** when the power goes off. ISDN lines do too—but your ISDN equipment doesn't. If you plan to use an ISDN line as your only voice phone line, invest in a small standby power supply so you can keep talking through those inevitable power outages. (You should have standby power for your PC, anyway.)

9 **There are two types** of ISDN line interfaces in use in the U.S. and Canada. Both use the same 8-pin RJ-45 connector, so it's easy to get them confused. The U interface is the actual line interface provided by your phone company. Unlike an analog phone line, a U interfaces can have only one device connected. Virtually all ISDN equipment sold for the SOHO market includes a U interface jack: You simply plug the line into the jack and forget about it.

The S/T interface, your second option, is more flexible, although now that most TA units include analog phone jacks, it's fading away. The S/T interface allows up to eight devices to be connected to a single ISDN line. To use it, you need a device called a network terminator, or NT-1. Included on some ISDN products and optional on others, the NT-1 box plugs into the ISDN U interface and provides two or more S/T jacks for you to connect to your equipment. Normally, you'd use the S/T interface to connect two or more devices—for example, your terminal adapter and one of those overpriced ISDN phones mentioned earlier.

Some detractors argue that ISDN offers too little, too late.

10 **They point to up-and-coming** technologies such as cable modems and *asymmetric subscriber digital line* (ASDL)—both of which offer bandwidth many times that of ISDN—and ask why anyone should bother with ISDN. Well, ISDN was an up-and-coming technology once too, and it took nearly ten years to reach its present status, where it is universally available. Remember that telephone companies take a long time to adopt any new technology. ISDN is here now, backed by international standards and ready to go.

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Who Needs Ethernet Anyway?

By Les Freed

The three solutions in our main roundup provide remote Ethernet connections in the physical sense: Each includes a 10Base-T connector on the rear panel of its client-side unit. Other ISDN products out there connect directly to a single PC, bypassing Ethernet altogether in favor of a less expensive software solution.

Interestingly, the two products we consider in this sidebar couldn't be more different, despite their fundamental operational similarities. 3Com's AccessBuilder 4000 ISDN, like the routers in our main roundup, is a freestanding box that attaches to your LAN via Ethernet or Token-Ring cable. Digi International's Datafire/4, on the other hand, is an internal card that you install in a server or dedicated LAN gateway PC.

FLEXIBILITY MAKES AN IMPACT

The AccessBuilder remote server is a flexible host-side router that can talk to a variety of ISDN, analog, and leased-line devices. At $3,495 for the basic unit, the AccessBuilder is reasonably priced. A four-line ISDN interface card costs an additional $3,495. The unit can host two cards, providing connections for as many as 16 clients at once. If you need a mix of analog modems and ISDN, you can install one ISDN card and one eight-port RS-232 interface card. You can connect up to eight external modems to the RS-232 interfaces.

The supplied Windows-based configuration software, 3Com Transcend AccessBuilder Manager, is a pleasure to use. You can run it from any computer on the LAN. When you start the program, it automatically locates any AccessBuilder units connected to the LAN. A step-by-step guided configuration makes the initial setup as painless as possible. What's more, Transcend's troubleshooting suite includes diagnostic and monitoring tools that really stand out from the competition's.

3Com bills the AccessBuilder as a multiplatform, open solution for remote access. It supports 3Com's own client solutions as well as virtually any PPP- or SLIP-compliant client, including Apple's MacTCP, many Unix clients, Windows 95 Dial-Up Networking, and Windows NT Remote Access Service. On the first try, we were able to connect the AccessBuilder to a Windows 95 PC with a Motorola BitSurfr Pro installed. That's no mean feat, for any of these products.

3Com's client offering combines its AccessBuilder Remote software for DOS and Windows and the 3Com Impact ISDN ISA Adapter. The Impact is available as a modem-size package or as an internal card (for more information, see "3Com Makes an Impact on ISDN," Network Edition, November 21, 1995). It provides PPP and Multilink PPP ISDN connectivity as well as an analog telephone port and optional V.32-compatible modem. The AccessBuilder client software can operate with virtually any ISDN terminal adapter or analog modem, so you're not locked into using 3Com's client products.

There's only one weak spot in the AccessBuilder lineup: performance. We didn't include the AccessBuilder in our product comparison charts, but it was significantly slower than any of the three solutions in the main roundup. Part of the problem is the AccessBuilder's lack of data compression, and part is the 115.2-Kbps limitation of the PC's serial port. Given 3Com's technical prowess, we don't expect this performance gap to last for long. Even without compression, the AccessBuilder is not a bad choice for companies that need a mix of modem and ISDN access ports.

FROM THE INSIDE OUT

Digi International offers an interesting, low-cost alternative to a traditional LAN router with its Datafire ISDN LAN adapters. These products combine one or four ISDN-line interfaces and a LAN adapter on a single card. At the host side, you install one of the four-line Digi Datafire/4 cards in a LAN file or communications server. The card appears to the server as an additional LAN card. A single-line Datafire card installed in the client PC connects to the host system over the ISDN line. The client card also appears to the client OS as a LAN adapter card and requires that you install LAN drivers.

> Each of these products connects directly to a PC, bypassing Ethernet in favor of a less expensive solution. But the similarities stop there.

Digi's software provides dial-on-demand connectivity between the server and up to four clients. Digi provides server drivers for NetWare 3.*x* and 4.*x*, Windows for Workgroups, and Windows NT Server. The Datafire server can talk to any PPP-compliant client as well as to other Datafire products. It's a very flexible system.

Because it's an internal card, the Digi Datafire/4 requires a bit more installation work than the other products we tested. And because the Datafire host software runs on the server, it makes some resource demands. Still, the performance penalty is minimal.

The Digi Datafire client does not provide a voice port, however—a feature we think is essential for products in the SOHO market. Still, if you need to connect just a few remote users, the Datafire is worth a look.

AccessBuilder 4000 ISDN. List price: $3,495; four-line ISDN interface card, $3,495. **3Com Impact ISDN ISA Adapter.** List price: $599. **3Com Impact ISDN External Digital Modem.** List price: $499. 3Com Corp., Santa Clara, CA; 800-638-3266, 408-764-5000; http://www.3com.com. *Circle 964 on reader service card.*

Digi Datafire/4. List price: $2,995. **Digi Datafire U Client.** List price: $595. Digi International Inc., Eden Prairie, MN; 800-344-4237, 612-943-9020; info@digi.com. *Circle 965 on reader service card.*

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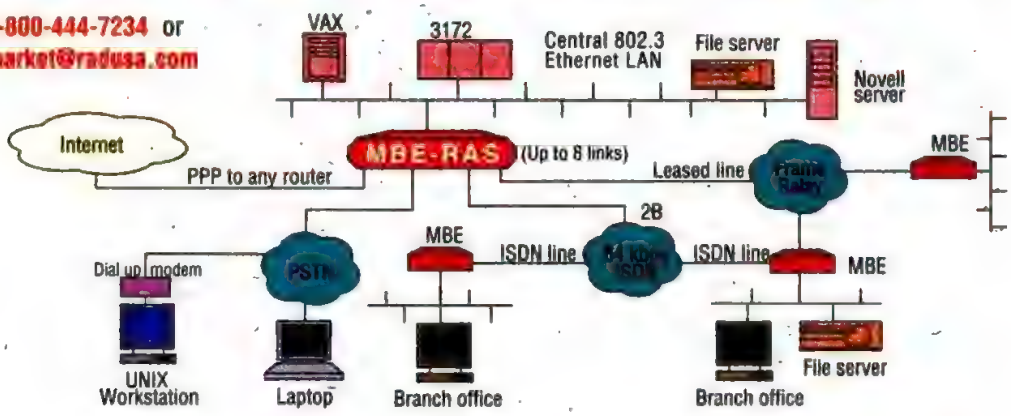

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4000 provides IPX and IP routing and bridging, and support for PPP, Multilink PPP, SLIP servers, SNMP management, and several user-authentication protocols, including CHAP and PAP. Ascend offers Frame Relay as an option. The management and control facilities are limited, as are those of the other two solutions we reviewed for the current roundup.

> The MAX 4000 and Pipeline 25 gave the illusion of a direct connection to the main-office LAN.

SOHO DELIGHT

The Pipeline 25 ($895 list) is the remote-office companion to the MAX 4000. Although it comes in a much smaller cabinet and supports only one ISDN line, the Pipeline 25 shares some of the MAX technology. The Pipeline 25 we tested was equipped with two options—Stac data compression ($300) and IPX routing (also $300)—which brought the total price of our test unit up to $1,495. Our unit also had a built-in NT-1 interface, which is a no-cost option.

The Pipeline 25 is the only product here that provides two analog telephone jacks. The two jacks mean you can use either one or both of the ISDN B-channels for phone, fax, or analog modem connections. This is an important feature for SOHO use, as it eliminates the need for additional analog lines for voice or fax communications.

It's important to note, however, that the Pipeline 25 supports only one user and one protocol at a time. If you need to connect multiple users at a single remote site, or if you need simultaneous IPX and IP routing, you'll need the more expensive Pipeline 50 ISDN Router ($1,695 with NT-1). The Pipeline 50 is similar to the Pipeline 25, but it is a higher-end product and does not support analog POTS (plain old telephone service).

GETTING CONNECTED

Both of the Ascend units were relatively simple to install and configure. Like the other routers we tested for this roundup, the MAX 4000 provides an RS-232 configuration connector. To configure the MAX initially, you must attach a PC running a VT100 terminal emulator to the serial port. Once you've completed the setup, if you're running TCP/IP on your network, you can use the telnet program to connect to the MAX 4000, eliminating the need for a serial connection and the VT100 emulator.

To get the MAX 4000 up and running, we only needed to enter our ISDN-line information and create a user account for the remote unit. The MAX 4000's operating software displays a combination status and configuration screen that shows the current status of each port and line attached to the MAX 4000. A menu bar on the left of the screen lets you scroll through configuration options such as ISDN-line configuration, user profiles, and router settings.

Like the MAX 4000, the Pipeline 25 requires a serial connection to a PC running a VT100 emulator, and it provides a similar configuration and setup screen. Setting up the Pipeline took about 5 minutes.

Once configured, the MAX 4000/Pipeline 25 combination performed flawlessly. There was a delay of a few seconds each time the remote client had to place a call to the host LAN, but once it was connected, the throughput was fast enough to give the illusion of a direct connection to the main-office LAN.

The MAX 4000's price tag is hefty compared with the other products reviewed, but Ascend markets the MAX 4000 primarily for use on ISDN PRI lines. In this configuration, the MAX 4000 can support 92 users (23 B-channels with 4 lines each), making its cost per port much lower than it first appears.

As we went to press, Ascend Communications had just released a smaller MAX unit that would probably make a lot of sense for smaller installations. The MAX 1800 ($7,200 list) is similar to the MAX 4000, but it comes with eight BRI ISDN ports instead of four T-1/PRI ports. It has two expansion slots, which can each accommodate an eight-port BRI board. The MAX 1800 was not available in time for us to include it in this review.

MAX 4000. List price: Basic unit, $18,500; four-line ISDN BRI interface, $4,500. **Pipeline 25 ISDN Router.** List price: $895; hardware compression option, $300; IP or IPX router option, $300. Ascend Communications Inc., Alameda, CA; 800-621-9578; http://www.ascend.com. *Circle 951 on reader service card.*

Gandalf Technologies Inc.

XpressStack BRI, XpressConnect LANline 5242i

Maybe you haven't heard the name before, but if you're in the market for an ISDN remote-access solution, you should keep Gandalf Technologies in mind. The XpressStac BRI remote-access server and the XpressConnect LANline 5242i, an ISDN client bridge, beat out the other products here on all runs of our File Throughput test. With the highly compressible file, this combination was more than 50 percent faster than its competition, helping it earn our Editors' Choice. You'd be hard-pressed to find a better solution.

The $9,500 XpressStack BRI provides a complete ISDN remote-access server in a single cabinet. This unit supports eight ISDN BRI lines and a single 10Base-T LAN connection. In case your needs grow beyond eight lines, you can link several XpressStack BRI units together to add more lines.

You make connections to the XpressStack BRI through the front panel, which has eight ISDN S/T jacks, a 10Base-T connector, a console port connector, and a bank of activity and status lights. Each ISDN line's jack has a diagnostic LED above it, a convenient feature that lets you check the status of the ISDN lines at a glance.

The XpressStack BRI requires a directly connected VT100 terminal or emulator to set the initial configuration. Once it's configured, you can make configuration changes to the XpressStack BRI via telnet. The configuration screen is clear and easy to understand, and the XpressStack BRI also supports SNMP remote management.

The XpressStack BRI supports Gandalf's proprietary link protocol, which provides dynamic bandwidth allocation. The XpressStack BRI also supports the industry-standard PPP link protocol and the CHAP and PAP authentication protocols. Althoughthe company claims it provides Multilink PPP support, the unit we tested did not. Without MP, non-Gandalf remote users can make only a single B-channel connection to the XpressStack BRI.

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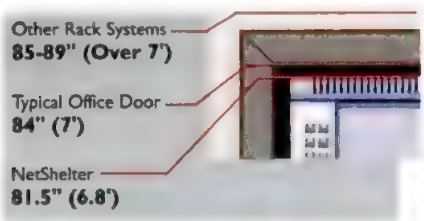

With optional accessories including Measure-UPS you can be warned about threatening events such as high-temperature or unauthorized access and prevent damage or downtime before your users–or management–even know there's a problem. Available for local, SNMP, and out-of-band management.

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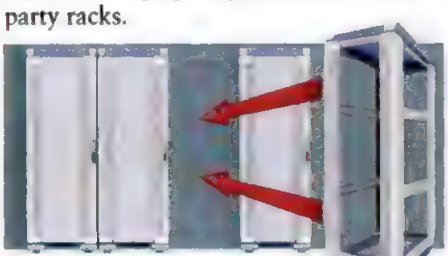

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Measure-UPS II	AP9612TH AP9612T	Temp, humidity and external sensors AP9612TH without humidity sensing.	$199 $149
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Measure-UPS Switch Kit	AP9813	Monitor cabinet access via Measure-UPS	$99

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Rating	Part#	Runtime	Price
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1400	SU1400RM	11	$1079
2200	SU2200RM	50	$1849
3000	SU3000RM	46	$2679

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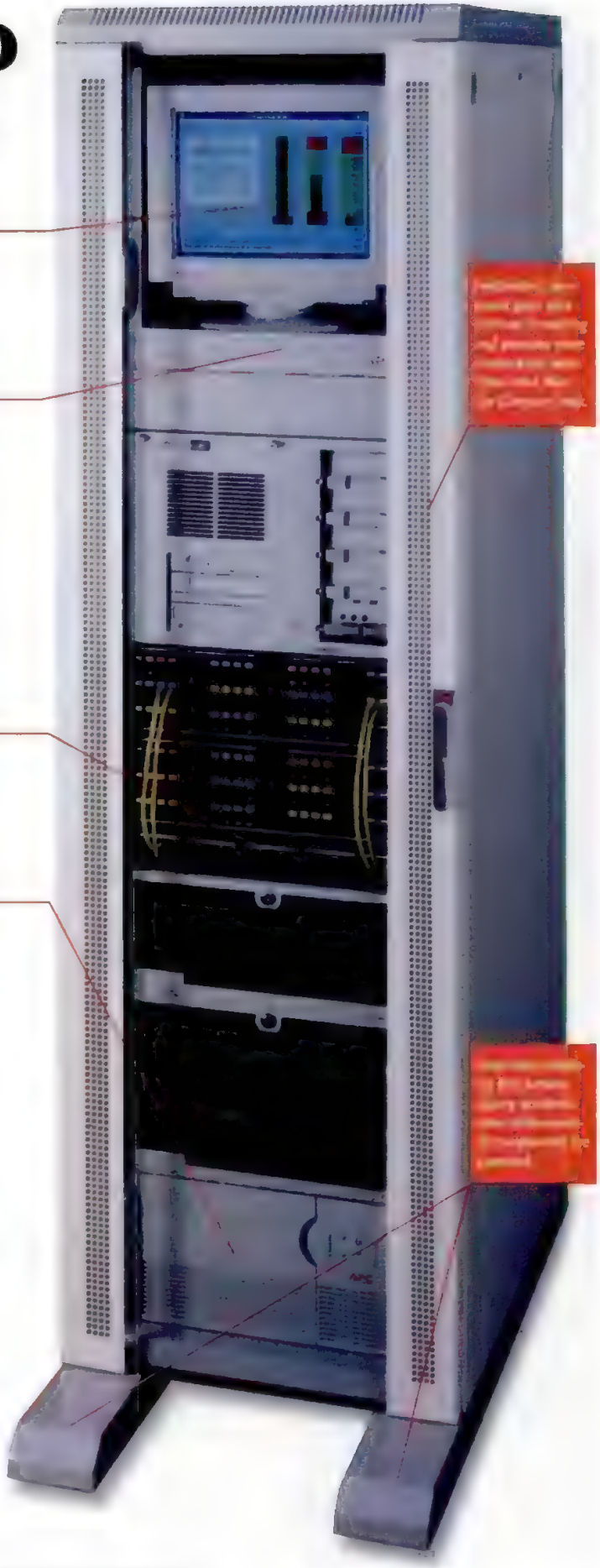

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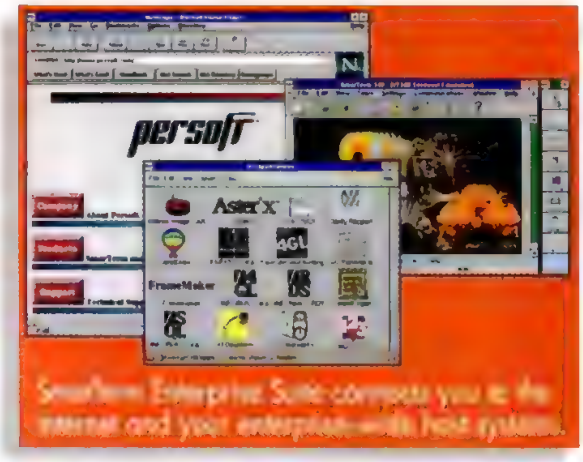

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PERFORMANCE TESTS

ISDN Remote-Access Routers

During testing, we looked at both the performance and the interoperability of these multiple-BRI central-site ISDN products. All performed well, but the Gandalf product, which uses twin RISC processors for compression, bested the others on every version of the test. Ascend's and Symplex's compression technologies depend on third-party and software solutions, respectively.

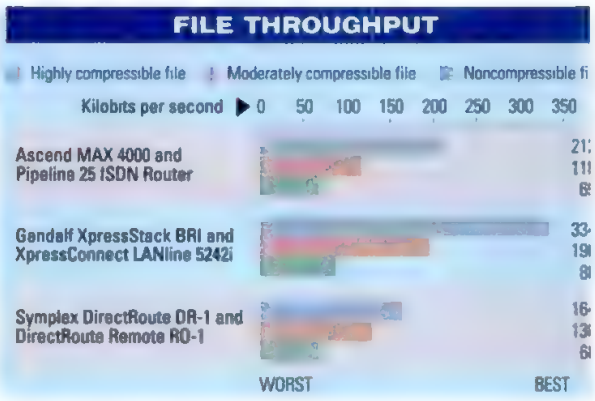
What the Numbers Mean

We found that the three solutions we tested—the Ascend MAX 4000 and Pipeline 25 ISDN Router, the Gandalf XpressStack BRI and XpressConnect LANline 5242i, and the Symplex DirectRoute DR-1 and DirectRoute RO-1—performed differently depending on the type of file we were transferring. We tested using compressible files, such as a text or vector graphics file; moderately compressible files, such as an executable file; and noncompressible files, such as JPEG files.

The Gandalf router was equipped with twin Intel i960 RISC processors to handle data compression. It was the best performer on our file-transfer test, no matter the file type.

Close inspection revealed that the Ascend solution, which uses a Stac compression chip, suffered when tested with our noncompressible file. This product's compression algorithm examined each data packet in each file, whether it was compressible or not—a process that wasted a lot of time. A smart compression algorithm should detect noncompressible files, suspend compression in order to save time, and reenable the compression as soon as the next compressible file comes in.

The Symplex product did not use a dedicated hardware compression chip. It performed software compression using its own AMD 29000 RISC CPU, which made it less efficient than the other two products in transferring the highly compressible file. In general, our test results showed that a file's compression ratio directly affects its transfer performance. The higher a file's compression ratio, the higher the file-transfer speed it will achieve. This happens because the compression engines in ISDN routers do not need to repeat the compression process for files that are already highly compressed.



How We Tested

We created a central-office network, including a NetWare 4.1 server and a Windows for Workgroups 3.11 local client. We also set up a Windows for Workgroups 3.11 remote client over an ISDN network. In some additional testing not reported here, we used a Windows 95 client. In general, Windows 95 provides a more robust base operating system for communications. All clients were running VLM 1.2.

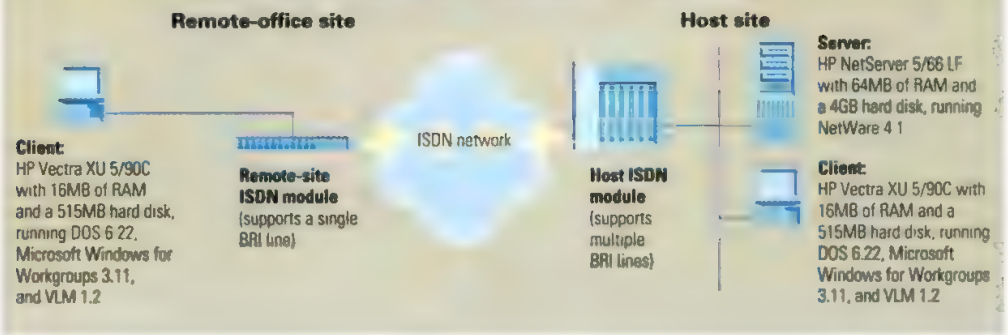
We asked each vendor to submit its multiple-BRI ISDN product for our central office network, as well as a single-BRI ISDN unit for a remote client. We tested each vendor's central product with its client unit, connecting each product to the test-bed via an RJ-45 connection.

To simulate typical remote users downloading files from their central offices over an IPX connection, we ran our File Throughput test with the following three files: a 983K vector graphics file that could be highly compressed (up to a 7.7:1 compression ratio), a 327K executable file that could be compressed moderately (up to a 2.5:1 compression ratio), and a 131K JPEG noncompressible file.

We transferred the three files from the network to the remote client and measured the speed of each transmission. We ran each version of the test three times to confirm the results.

For our interoperability tests, we connected the products to a Motorola BitSurfr Pro installed in the remote client. The BitSurfr Pro is fully compliant with Multilink Δ6. We tested each product's ability to complete an ISDN call, to perform PAP and CHAP authentication, and to utilize both B channels successfully.

ISDN Remote-Access Test-Bed



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AND AT THE OTHER END

The XpressConnect 5242i client bridge is housed in a sturdy metal chassis that is wide enough to place your telephone on. It has two incarnations: the Teleworker Bridge and the Edge Router. Both versions have the same model number and use identical hardware. A flash ROM update turns one into the other.

With the Teleworker Bridge software installed, the XpressConnect 5242i provides LAN bridging via Gandalf's proprietary protocol. In this configuration, the XpressConnect 5242i can talk only to another Gandalf product.

We tested the more flexible Edge Router package. With this software, the XpressConnect 5242i becomes a full-function, multiprotocol bridge/router. It can route IP and can bridge IPX and other protocols. The Edge Router supports the PPP and Multilink PPP link protocols as well as the CHAP and PAP security protocols, making it compatible with most of the remote-access products from other vendors.

Our XpressConnect 5242i test unit was also equipped with voice support, a $305 option. The XpressConnect 5242i provides a single POTS port for your phone, fax, or modem. Voice quality over the POTS port was excellent, with no noticeable hum or background hiss.

You can configure the XpressConnect 5242i in one of two ways. In addition to operating through the standard RS-232 configuration port, the XpressConnect 5242i lets you run your setup by entering codes through a Touch-tone telephone. You can configure most of the XpressConnect 5242i's options from the keypad, but we used it only to enter our unit's IP address. After the address was entered, we were able to communicate with the XpressConnect 5242i via telnet, eliminating the need for a serial cable and terminal emulator.

For the more mainstream user, Gandalf provides two Windows-based configuration programs for the XpressConnect 5242i. The first program communicates via the serial port, the other via TCP/IP. The serial port program has a convenient guided setup that walks you through all the steps necessary to configure the XpressConnect 5242i.

Another unusual but helpful feature is a single button on the front panel, which, once programmed, lets you dial the host system of your choice with a single push. If you're already connected, the connect button brings the ISDN link down immediately. A set of two-color status LEDs show LAN and ISDN activity and are helpful for troubleshooting. All in all, the XpressStack BRI and XpressConnect 5242i are an impressive combination.

XpressStack BRI. List price: $9,500. **XpressConnect LANline 5242i.** List price: Data-only version, $1,245; with voice option, $1,550. Gandalf Technologies Inc., Nepean, Ontario, Canada; 800-426-3253; http://www .gandalf.ca. *Circle 954 on reader service card.*

Symplex Communications Corp.

DirectRoute DR-1, DirectRoute Remote RO-1

Don't let their unusual appearance and low price put you off. Symplex Communications' DirectRoute DR-1 and DirectRoute Remote RO-1, which cost a little less than the other products here, take a different, more transparent approach to ISDN routing. But that difference pays off. DirectRoute is a capable system that provides high-level performance and flexibility.

> Symplex takes a more transparent approach to ISDN routing than the others. And the difference pays off.

The four-BRI-line DR-1 router costs $2,999 with S/T interfaces and $3,799 with U interfaces. Apparently targeted at multiple-router remote locations, the companion RO-1 was the only product we tested that did not include a POTS jack—a feature that appeals to the SOHO marketplace. The RO-1 remote router costs $1,299 with an S/T interface and $1,399 with a U interface . Comparable products from other companies, such as Ascend, cost upwards of $1,695.

AN EASIER ROUTE

As true routers—not bridges—Symplex's products employ a clever technology that takes the hassle out of routing. If you've ever configured a router, you know that you usually need to compile a detailed list of IP and network addresses, since each router in your organization needs to know the address and location of every other router. With most products, someone has to enter the routing table data manually, updating it as new routers are added and old ones are removed.

Symplex simplifies this process using a technique called *Silent Routing*. This system automatically learns the address and route of every device on the network, then builds its own routing table. Thus a single remote user can automatically connect to any of several host LANs without knowing the phone number for each individual host router.

The RO-1 remote router can connect to two host routers simultaneously. RO-1s can also connect to one another to provide branch-to-branch routing.

NO-SWEAT INSTALLATION

The DR-1 main-office router comes with four BRI ISDN-line interfaces, an autoswitching 10Base-T/AUI Ethernet port, and an RS-232 serial port for the configuration console. The DR-1 also has two serial ports for connecting frame-relay or leased-line equipment.

Configuring the DR-1 was a pleasure: we had the it up and running in 10 minutes. The first time you start it up, the unit's software walks you through the configuration process. You need enter only minimal information, such as the phone number and SPID of each ISDN line, and the name and phone number of each remote router. If you're using TCP/IP, you need to know the IP address and network mask for the DR-1.

The RO-1 remote router is a modem-size black box. Its rear panel has connectors for its external power supply, an ISDN line, a configuration port, a 10Base-T connector, and one AUI port. Although the product supports multiple users—which makes it ideal for multiple-PC remote offices—it also comes with a 10Base-T "crossover" cable for connection to a single workstation. You can also connect the RO-1 to an Ethernet hub.

The RO-1 is operationally similar to the DR-1, and has the same first-time configuration screens. We had the RO-1 up and connected to our test LAN within minutes.

The DR-1/RO-1 combination performed very well. Although the Symplex products didn't lead the pack on any of our performance test runs, they weren't significantly behind the others. If you're looking for a remote-access solution for just a few users—and you don't need voice support—Symplex's routers could be your best option. □

DirectRoute DR-1. List price: With S/T line interfaces, $2,999; with U interfaces, $3,799. **DirectRoute Remote RO-1.** List price: With S/T interface, $1,299; with U interface, $1,399. Symplex Communications Corp., Ann Arbor, MI; 800-327-9926; http:// www.symplex.com. *Circle 955 on reader service card.*

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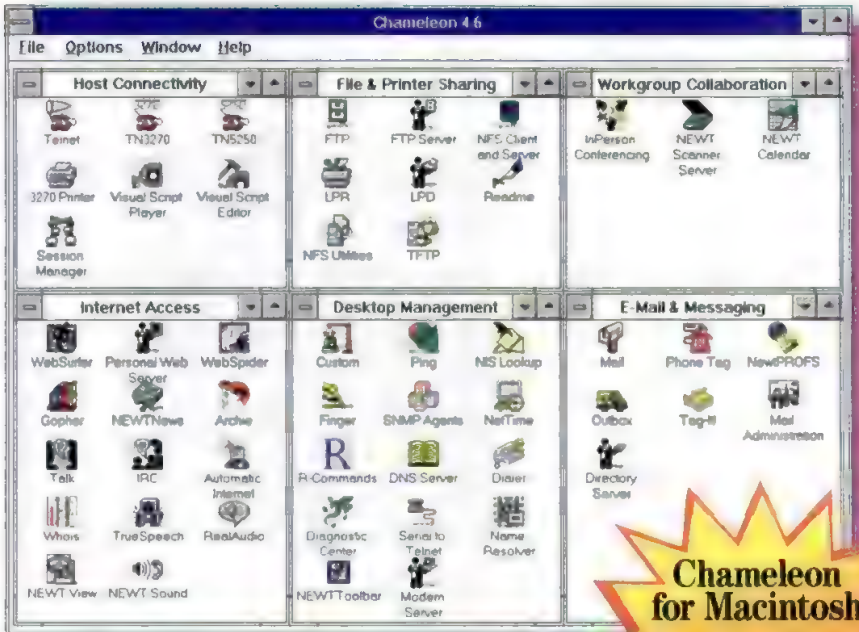

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Chameleon Desktop also includes six powerful servers! NFS Server, FTP Server, Web Server, Directory Server, PC Net-Time Server, and Domain Name Server.

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Chameleon Desktop includes WinSock TCP/IP and is 100% DLL/VxD. Chameleon requires only 6KB memory and sets up in five minutes.

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Stac develops and markets networking and storage technologies, systems management software and Internet applications for the enterprise.

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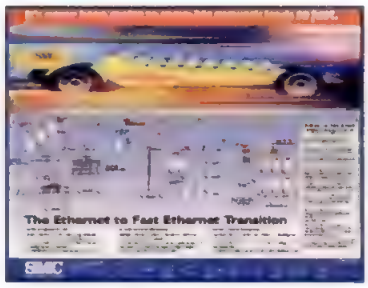

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WINDOWS NT MANAGEMENT SOLUTIONS

Intel Manages NT

By Steve Rigney

You would need all of your fingers and most of your toes to count the number of network management packages available for NetWare, but the same can't be said for Microsoft Windows NT. As Windows NT's popularity as a network platform grows, so does the need for detailed client and server management information.

In the past, you had to rely on Microsoft's Systems Management Server (SMS) for Windows NT management. The $649 SMS is fairly complicated to install, needs lots of hardware, and requires Microsoft's SQL server. As an alternative to SMS, Intel's LANDesk Management Suite is designed to provide you with all the information you need on your Windows NT servers and the client PCs connected to them.

The LANDesk suite is easy to install and includes the Server Manager Pro, Virus Protect, and Workgroup Manager. We looked at the network management capabilities of the Server Manager Pro and the Workgroup Manager.

Intel Corp.

LANDesk Server Manager Pro

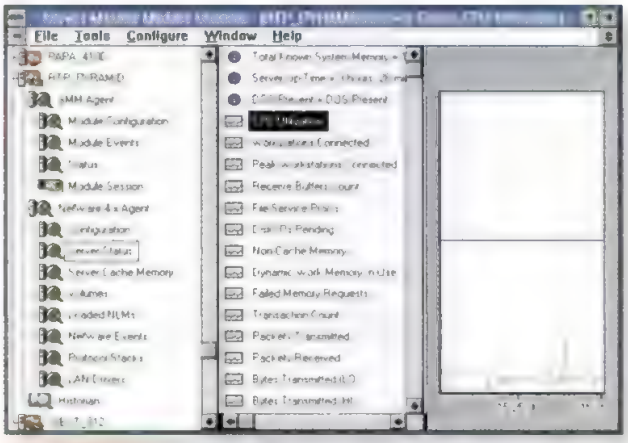
If you want to add management to your network, the obvious starting point is your file server. It's the most important PC on your network, and even if you don't manage your client PCs, you should always have some way to keep tabs on your servers. Intel's $1,499 LANDesk Server Manager Pro is a handy combination of hardware and software that allows you to monitor and manage all of your NetWare and Windows NT servers.

Server Manager can keep track of hundreds of server statistics, alert you to possible server problems, allow you to remotely control any server, and even monitor the temperature and voltage of your hardware. (Currently, though, the remote control and notification features work only with NetWare-based servers.)

The hardware portion of Server Manager is a full-length ISA adapter called the Monitor Module. This adapter plugs into a standard slot on your server's motherboard and includes an 8086 CPU, a Type 2 PCMCIA slot, and a rechargeable battery pack. You can install a PC Card modem on the board and monitor your servers from a remote location. Server Manager guarantees compatibility with only five PC Card modems, but more modems will be added to the list.

The Monitor Module works in both NetWare and Windows NT servers. It can monitor hundreds of statistics if the server is running, including disk access, memory usage, and processor utilization. If you're monitoring a NetWare server, you can even remotely control the system console to load and unload NLMs.

If the server is down, you can connect to the Monitor Module and try to re-boot the server or monitor any error codes. The battery pack can run for up to four hours, which should be plenty of time to diagnose or fix any errors. The memory on the adapter can store important messages or problems from before the server went down.



DUAL MONITORING: *Unlike SMS, Server Manager allows you to monitor both NetWare and Windows NT.*

While the Monitor Module is ideal for remote troubleshooting, the Server Manager Console is the best tool for gathering statistics. Server Manager can monitor up to 250 different items. The statistics include information on your processor, system, memory, hard disk, network, and application. You can

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MANAGEMENT SOLUTIONS

LANtastic's Fantastic Options

By Steve Rigney

We've all read "Batteries included" on packaging for toys, tape players, and electronic devices. And though the box may contain decent batteries that work for a while, you're probably better off buying your own Duracells. Similarly, most network administrators would agree that the built-in network features in Windows 95 are a great selling point of the OS. But the Windows 95 NOS doesn't provide strong security, and it requires that you run Windows NT, Windows 95, or Windows for Workgroups on all your client PCs. In addition, some administrative tasks, such as sharing drive letters and creating user information, are unintuitive and easy to miss.

Artisoft offers a solution in LANtastic for Windows 95, Version 1.0, a product that lets you easily connect your client PCs (running DOS, OS/2, Windows 3.*x*, Windows 95) and even your Macintoshes to a LANtastic server. LANtastic for Windows 95 retails for $119 for a single license, and it offers great security and an intuitive interface.

The LANtastic for Windows 95 program is shipped on a CD-ROM and is extremely easy to install. Similar to the other network features in Windows 95, you install LANtastic using the network option in the Control Panel.

In addition, LANtastic for Windows 95 can exist with the other network services you have

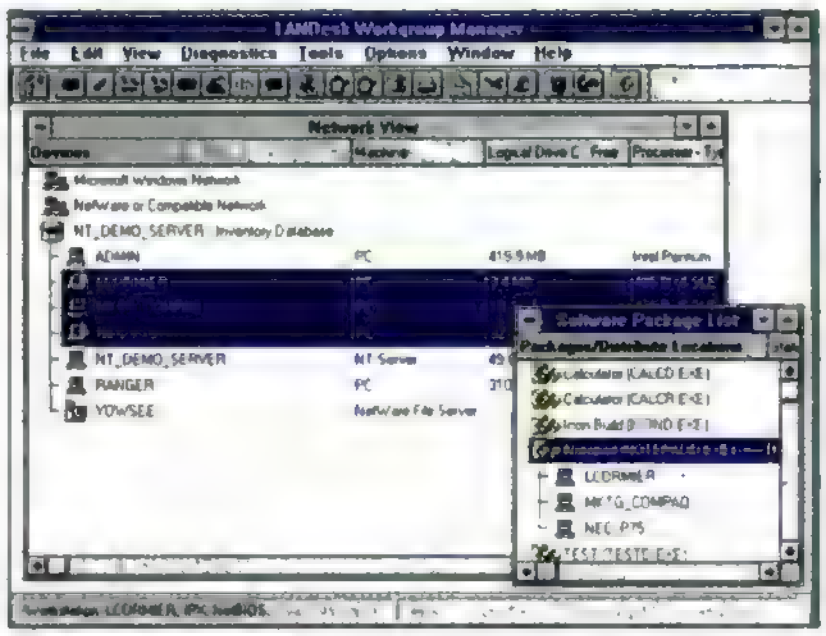
Continues on page NE31

LANDesk

Continued from page NE27

view each statistic in a graph and create a histogram to monitor information over time.

The Windows NT performance monitor offers similar statistics but allows you to monitor only a single server. Server Manager, on the other hand, allows you to monitor multiple Windows NT and NetWare servers from a single location.



SELECT USERS: *With Workgroup Manager, you can select users to receive a software package.*

Both the hardware and software components are easy to install; setup and configuration took us only about 30 minutes. The only problem we encountered occurred during attempts to monitor our Windows NT server across the LAN. To find all of the Windows NT servers running the Server Manager product, you must know the IPX and network node addresses of each one. But after you enter the addresses, the program saves them and you will be able to reconnect automatically the next time you start the Server Monitor console.

LANDesk Server Manager Pro, Version 1.0. List price: $1,499. Intel Corp., Santa Clara, CA; 503-264-7354; http://www.intel.com/comm-net. *Circle 966 on reader service card.*

Intel Corp.

LANDesk Workgroup Manager

For network remote control, software distribution, and hardware and software inventory for all your Windows NT and NetWare client PCs, Intel offers the LANDesk Workgroup Manager, a great, easy to use and install software-only solution. Workgroup Manager offers the same interface and software diagnostic capabilities as the Server Manager Pro. It can monitor 100 client PCs at the same time, whereas LANDesk Management Suite for NetWare can simultaneously monitor 1,000 nodes. Workgroup Manager retails for $999 for a 25-user license; each server you monitor requires another license.

Of Workgroup Manager's features, one of our favorites is the ability to remotely control all of your DOS, NetWare, Windows 3.x, and Windows 95 PCs from a single location. You can't remotely control PCs running Windows NT, but Intel is working on that.

You can use Workgroup Manager to remotely control any Windows- or DOS-based PC running the 6K remote TSR. You can run the remote-control utility over any network using the TCP/IP, IPX, or NetBEUI protocols. Although other products, including SMS, allow you to remotely control client PCs, Workgroup Manager is one of the few that allow you to control your NetWare servers.

Workgroup Manager uses a concept called "software packaging" to distribute files and applications to users on the network. Software packaging is an easy, step-by-step process. Other programs require you to write complicated scripts.

All of Workgroup Manager's software distribution is performed from a single PC running the Distribution console. The entire software-distribution process requires three steps. The first step involves scanning the hard disk on your distribution PC to find all the applications and other files.

With the second step, you install your new application or edit an existing configuration. The program will re-scan your hard disk to note the changes and to create the software package.

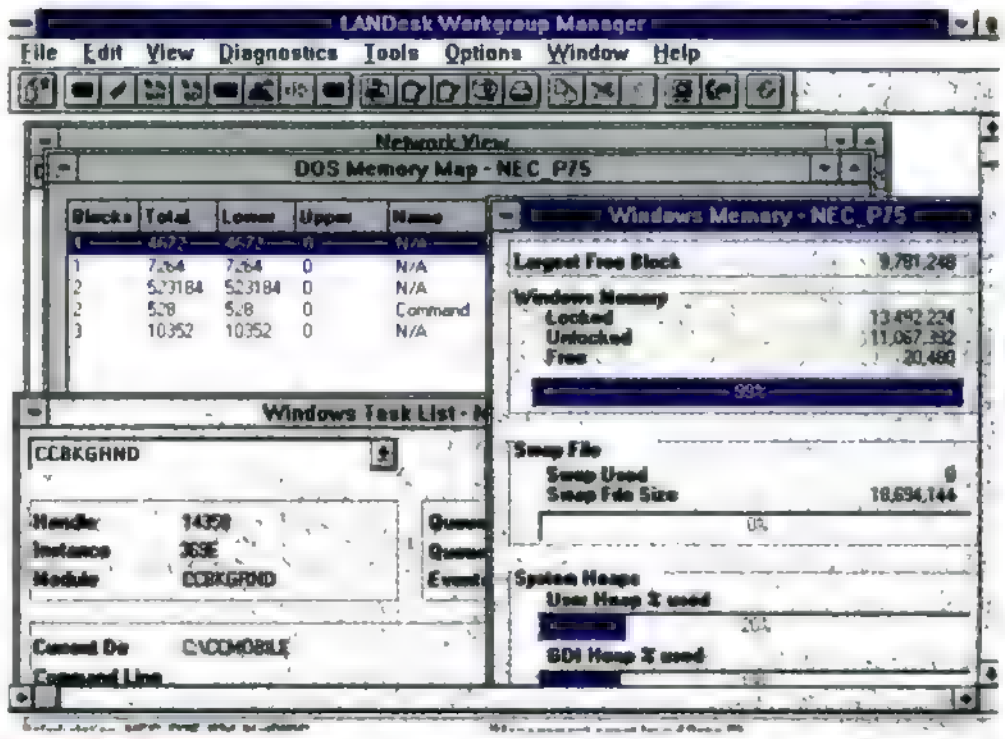
The third step involves sending the software package to individual users based on a filter. The filter allows you to determine which users get the package. The user can ignore the package, wait to install it, or make changes at once. The distribution utility doesn't force a software distribution to any user.

The hardware and software inventory utility relies on a scan program on each of the client PCs and Windows NT servers to gather the information. The scan program will determine the types of hardware and software installed on each user's PC.

Workgroup Manager also includes an NLM that will scan the hardware and software information on your NetWare file servers. You can use the inventory information to create detailed reports that you can view on the screen or in print.

What You Get: LANDesk vs. SMS

■ YES ▫ NO	Intel LANDesk Workgroup Manager for Windows NT	Microsoft Storage Management Server
General Features		
Software inventory	■	■
Hardware inventory	■	■
Software metering	▫	
Software distribution	■	■
Server replication	▫	■
Network traffic monitoring	▫	■
Remote Control		
DOS	■	■
NetWare	■	▫
Windows 3.x	■	■
Windows 95	■	■
Windows NT	▫	▫
Server Statistics		
NetWare	■	▫
Windows NT	■	▫



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MIPS RISC

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Crosstalk

Gail Shaffer

"Frank, it's about time that people using Windows NT servers got an alternative to Microsoft's SMS. Windows NT is increasingly important for database, communications, and even intranet servers. And the PC Card slot on Intel's monitor module is a great way to build in flexibility. The workgroup package seems like a toy for control freaks, but I see its value."

Frank Derfler

"People often don't appreciate these server and system monitoring tools, Gail. SNMP is good for wide-area networks, but it's overkill for many LANs. This Intel family provides server and LAN monitoring products that can avoid disasters or simply improve planning for a small investment."

The Workgroup Manager interface is the same as the one in Server Manager, and you can use the Workgroup Manager console to monitor PCs running the Server Manager software. Both products offer the same level of statistical reporting and most of the same software diagnostics. It would be great to be able to remotely control Windows NT servers; we hope this will be possible with a future release.

LANDesk Workgroup Manager, Version 1.0. List price: $999. Intel Corp., Santa Clara, CA; 503-264-7354; http://www.intel.com/comm-net. *Circle 966 on reader service card.*

LANtastic

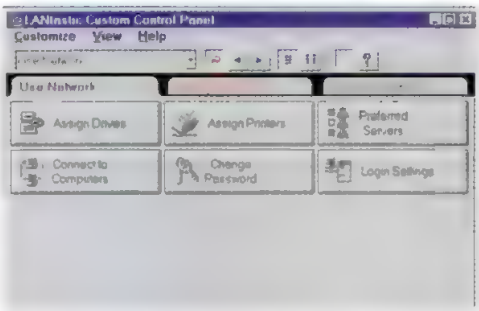
Continued from page NE27

installed. For example, you could install all of the network drivers you need to connect a single client PC to a Microsoft Windows NT, Novell NetWare, and LANtastic server. LANtastic for Windows 95 uses the NetBEUI network protocol, but you can also run NetBEUI over TCP/IP. On our test PCs, we installed the IPX, NetBEUI, and TCP/IP protocols.

The security options in LANtastic for Windows 95 are strong and impressive. Whereas Windows 95 allows you to protect only the passwords of individual network resources, such as subdirectories and printers, LANtastic allows you to set up users and groups with different levels of network rights.

For example, you can set up each user on your network with dozens of different security options, including the rights to view and edit files, to create folders, and to access printers and CD-ROMs. You can even set up four levels of supervisor access. Furthermore, you can save the security settings you create as templates so you can control the access rights of multiple users or groups.

Most of the network options and utilities in Windows 95 are hidden in the Control Panel or Explorer utilities. If you want to connect to a network server, for example, you must select the name of the server and use the right-mouse button or Tools command to map a network drive.



TAKE CONTROL: *You can use the LANtastic control panel for all of your network tasks, including connecting to other servers.*

LANtastic for Windows 95 includes a customizable Control Panel utility that allows you to perform all your network tasks easily. The LANtastic Control Panel includes 16 custom tabs and the ability to add 100 different application icons. You can use the Control Panel to generate individual menus for all of your users; you can even create a tab with your company's name and logo.

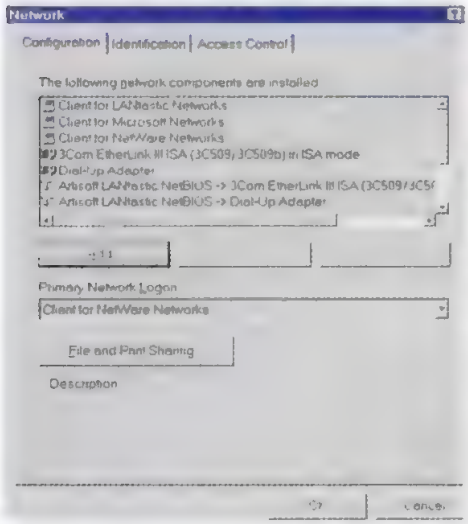
We encountered a problem with the program only when we tried to use an existing Artisoft Node Runner network adapter. Apparently, there is a problem with the Microsoft NDIS drivers when it's used with any adapter that uses a National Semiconducter chip set, such as the Artisoft Node Runners and NE2000 adapters. If you have more than six or seven PCs on your network and you perform a traffic-intensive file copy, you could corrupt your data.

The folks at Artisoft recommend that you install these National Semiconductor adapters in 8-bit mode to fix the problem. Although doing this will slow down performance, it's preferable to losing your data. Artisoft includes a README file that explains how to fix this problem.

Missing from the LANtastic for Windows 95 package are e-mail, scheduling, and network fax capabilities. Other versions of LANtastic (including the Artisoft PowerSuite and LANtastic 6.0 for DOS and Windows) included Windows-based e-mail and scheduling. The developers at Artisoft decided to leave these features out of this version, but you can use third-party e-mail or scheduling programs with LANtastic for Windows 95.

It may seem that LANtastic for Windows 95 would only be an appealing product if you're using a LANtastic network. But with its strong security features, easy-to-use interface, and ability to connect to client PCs running DOS, OS/2, and Windows, you might consider adding LANtastic to your existing peer-to-peer or server-centric LAN. With Windows 95, you don't have to stick with one NOS or one protocol, so why not pick the best of what's available?

LANtastic for Windows 95, Version 1.0. List price: $119 per single license. Artisoft Inc., Tucson, AZ; 800-846-9726, 520-670-7100; fax, 520-670-7101; http://www.artisoft.com. *Circle 967 on reader service card.*



SAME DEAL: *The LANtastic for Windows 95 drivers install the same way as the other network features of Windows 95, in your control panel.*

VIDEOCONFERENCING SYSTEMS

You Can Take It with You

By Les Freed

In the opening scene of the film of Michael Crichton's *Congo,* a search team looking for a lost city deep in an African jungle is having a videoconference with company headquarters in Houston. They're using a portable videoconferencing system that is connected to a portable satellite dish. In the movie, the image is crystal-clear, and there's no delay or echo. But that's Hollywood.

Here in the real world, we have H.320, the widely accepted standard for ISDN videoconferencing. Though not as good as the system in the movie, it is the first industry-wide standard for videoconferencing on ISDN lines. And true, we don't have ISDN via satellite yet, but if and when it becomes available, a system for using it already exists—the Dolch L-PAC PC.

Dolch Computer Systems has combined its industrial-strength lunchbox PC with Intel's ProShare Video System 200. The result is a complete, full-color H.320 conferencing system with a handle, and a sizable price tag.

Customized, expandable portable PCs happen to be Dolch's specialty. Most of its machines are built to order, and consequently, they aren't cheap. The basic L-PAC unit is available with a variety of CPU options, ranging from a 486/66 at the low end to dual Pentium/120s at the high end. For our review, Dolch supplied an L-PAC 586-120E.

The machine that we tested was loaded with options, including an active-matrix color display, a 2GB SCSI hard disk, a CD-ROM drive, built-in speakers, and 32MB of RAM. In this configuration, the L-PAC costs more than $11,000. To that, Dolch added Intel's $1,999 ProShare ISDN videoconferencing system as well as a Toshiba color LCD camera.

The ProShare system includes three software packages: H.320-compatible and PCS-protocol conferencing software, and Intel's Premier Edition document-sharing app. Intel's proprietary PCS standard provides a better picture than H.320 but works only with other Intel systems.

MOVE IT: *The L-PAC PC is good to go; just remember to keep a firm hand on the costly parts.*

Although this is a portable system, there's lots to connect before you can communicate with the home office. First, you connect the external camera to the PC and the power supply to the camera. Next, you connect the ISDN line to the NT-1 interface. The NT-1, which requires its own power supply, connects to the PC via an RJ-45 cable. And the last step is to connect the ProShare speaker/microphone to the PC. This sounds more complicated than it is, but you'll need three AC outlets in addition to the ISDN line.

Before you can establish a conference, you must set the ISDN line information (phone number, switch type, and SPID) in the ProShare software. This takes only a few seconds once you know how to do it, but you must change the setup information each time you move the system.

After we got everything connected and configured, the system worked smoothly. The supplied Toshiba camera provides a crisp, clear picture with good color and contrast. The received picture looked surprisingly good; we had never seen a videoconference on an active-matrix screen before. We were also able to call several other Intel ProShare systems, as well as non-Intel H.320-compatible systems, without a hitch.

Conferencing duties aside, the Dolch is a competent computer in its own right. Our test unit was very fast, thanks to a large SCSI hard disk and 32MB of RAM. The 10.7-inch active-matrix screen is bright and easy to read, but you have to be sitting right in front of it to see it. Unlike most laptops, this system doesn't let you tilt the angle of the screen. Two flip-down feet under the front of the unit help a little, but they also make the whole box unstable—and you don't want to see $13,000 worth of hardware fall off the desk.

You can connect an external monitor, which can be active at the same time as the L-PAC's internal unit. The detachable keyboard was a little stiff, and one key stuck repeatedly, a problem we've seen in other Dolch units. Our test PC didn't have an integrated pointing device, something we've come to appreciate on newer portables.

So what do you do with a portable videoconferencing system? Because of the size and cost, most videoconferencing systems are permanently installed in conference rooms. The Dolch system lets you bring the conference wherever you want, provided an ISDN line is nearby.

Companies that use ISDN for remote LAN access or work-at-home employees can buy one or two Dolch machines to let work-at-home or remote-office folks do videoconferencing with the main office. Large organizations with lots of ISDN lines in one place can use the Dolch system in lieu of a permanently installed conference-room system. Just be careful not to drop it while moving it from room to room, or your company may send you on a business trip to the Congo.

Dolch L-PAC PC with Intel ProShare Video System 200. List price: Varies with configuration. Dolch Computer Systems, Fremont, CA; 510-661-2220; fax, 510-490-2360. *Circle 968 on reader service card.*

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Proactive protection.
And once PowerWise is on line, it provides reliable, unattended shutdown of server and network operations. It monitors and predicts battery failure in advance. It even gives you remote central management through a single OpenView console and remote paging capability. Plus, it includes inventory reporting capabilities that display all the vital statistics of UPSs on your network. All of which leaves you more time to deal with the rest of your demanding job.

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http://www.hp.com/go/netserver

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* List prices as of October 1, 1996. † PowerWise Assistant; shutdown, management and diagnostics software for Windows NT and Novell Netware (other OSs available separately). © 1996 Hewlett-Packard Company. All rights reserved.

RAID CONTROLLERS

Off-the-Rack RAID

By Charles Lin

When it comes to backing up and storing data, we hold certain truths to be self evident: All data is created equal, and it needs to be stored. RAID (redundant array of inexpensive disks), which has been around for years, is one of the best storage solutions: It gives you the redundancy you need without mirroring each hard disk. For small businesses, however, the cost of RAID has been prohibitive, but not anymore. Adaptec, a major player in the SCSI controller market, has just introduced its PCI RAID controller, the AHA-3985, with a price tag of only $795.

With the release of this product, Adaptec has made its first foray into the RAID-controller market. And the debut has been remarkably strong. Aimed at server environments with less than 50 clients, the AHA-3985 is an affordable RAID controller. Currently, Adaptec sells a narrow SCSI version for $795 and a wide version (AHA 3985W) for $849. Also included with the controller is Adaptec CI/O RAID management software, HP OpenView, and a server-based NLM tape backup utility.

According to officials at Adaptec, they were able to offer the AHA-3985 adapter for such a low price by designing it around the PCI bus architecture. The ability to move data off-bus without much buffering on the adapter means that the AHA-3985 only requires one megabyte of expensive onboard DRAM. Each SCSI channel on the adapter is controlled by its own Adaptec 7170 chip.

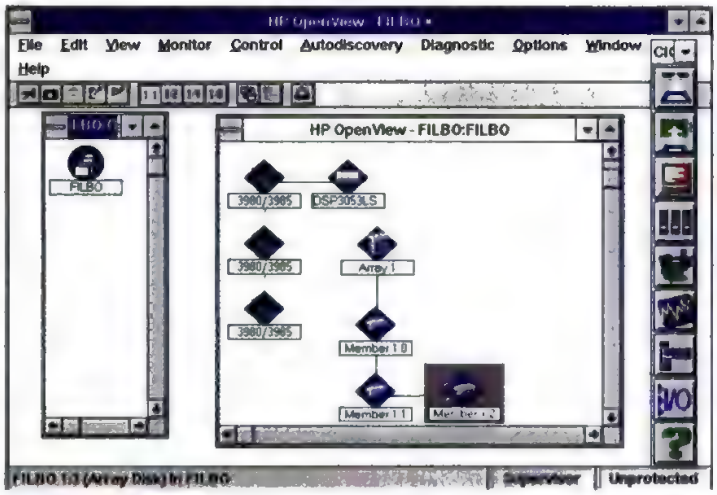
Now for a little refresher on how RAID works. RAID combines multiple disks in an array that appears as a single disk to the operating system. Using parity information, RAID offers data redundancy to multiple disks while sacrificing only a single disk's worth of storage.

RAID Level 5 adds even more functionality by distributing the parity information evenly across the array, thus allowing any disk to fail without disrupting services to the clients. For a couple of thousand dollars more, you can purchase a hot-swappable subsystem that will allow you to replace the failed device without taking down the server.

RAID also provides excellent protection against hard-drive failures, but it isn't a replacement for a backup device. Adaptec has included ProServ CX Lite tape backup software from Sytron Inc. with the AHA-3985 adapter. ProServ uses NLMs on the server to conduct the backup operations, however, a Windows front-end can control the backup process.

ProServ CX Lite doesn't have the features found in packages such as Arcada Backup Exec, but it does offer an easy-to-use backup solution for a small LAN environment. You can use it to schedule backup jobs and make partial backups of modified files.

Like most PCI-bus devices, getting the device up and running is easy because hardware installation is a snap. If you're comfortable modifying your NetWare server configuration, installing the AHA-3985 in your existing file server will be no trouble at all. Once the driver for the AHA-3985 is loaded, simply load the NLM-based RAID management program to create and manage the array.



MANAGEMENT BONUS: *Adaptec includes its CI/O RAID-management software with the AHA-3985, a nice addition.*

From the management program, we created a RAID-5 array and selected the drives to be included in the array. The utility also allows you to format the array and check for bad sectors. Once the array is complete, NetWare's installation utility will detect it as a single partition. Creating and mounting the array as a NetWare volume is all that remains to be done.

All essential RAID tasks are built into the AHA-3985 RAID administration utility, including RAID status, media verification, reconstruction, formatting, and changing RAID configuration. We found the status information lacking in detail.

The included SNMP-based CI/O software gives a much better graphical view of controller statistics. When a failure does occur, the server sounds an alarm and displays the hardware failure on the console. The CI/O software also displays an alarm in the administrator's workstation via OpenView SNMP environment. With third-party SNMP products, OpenView can alert you to the problem via pager or e-mail. Once the failed hard drive has been replaced, reconstructing the data can be done only through the server-based utility.

Adaptec indicated that the next generation of adapters and CI/O software will no longer require SNMP, which will allow administrators to schedule a reconstruction of data from an administrative workstation. Using a server console, we were able to schedule a reconstruction at a later time and select a priority level.

Priority level limits the number of reconstruction functions among user requests. When user requests are low, however, the adapter is smart enough to increase the number of reconstruction functions so that the recovery process is speeded up. The manual doesn't provide any guidelines for choosing priority levels, and Adaptec hasn't released any information on the effect of priority level on CPU utilization.

We tested the Adaptec AHA-3985 in our 133-MHz Pentium-based server running Novell's NetWare 3.12 Network Operating System. Our four-disk SCSI array was housed in an external hot-swappable subsystem, the DataSilo. A single client attached to the server acts both as the client and as the management workstation.

AHA-3985. List price: $795; **AHA-3985W,** $849. Adaptec Inc., Milpitas, CA; 408-945-8600; fax, 408-262-2533; http:\\www.adaptec.com. *Circle 969 on reader service card.*

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JUNE 1995 BYTE BEST VALUE V.34 EXTERNAL MODEM

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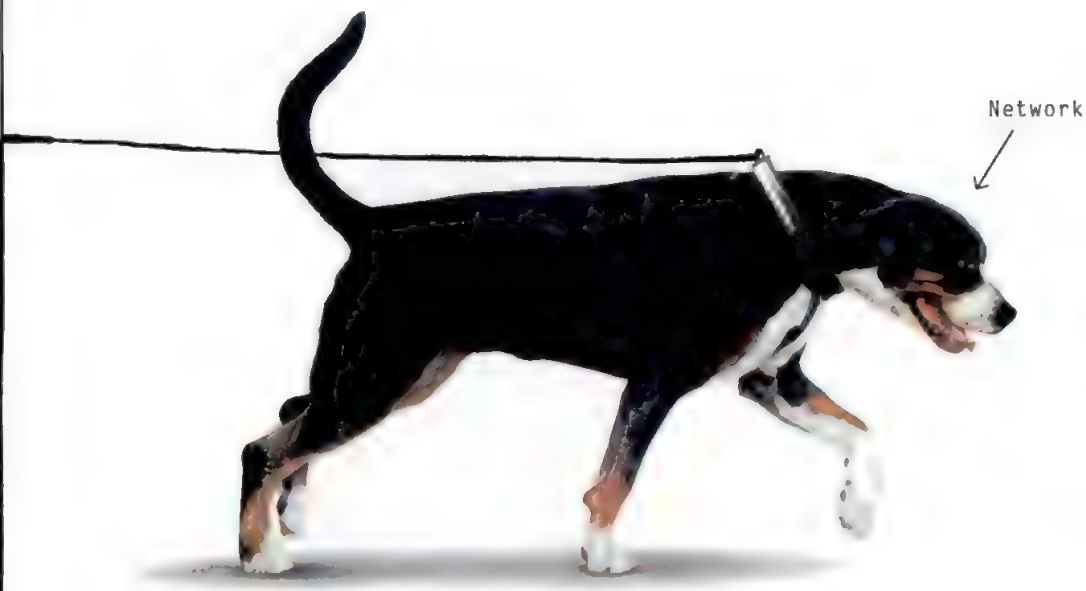

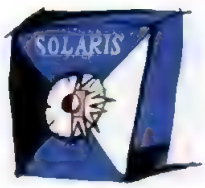

And so do the analysts at D.H. Brown. In a recent study, they ranked Solaris™ as the best enterprise network operating system.* Ahead of Windows NT. And above NetWare.™ Then again, why wouldn't they? After all, Solaris provides serious power you can add to your PC workgroups. While protecting your NetWare and Microsoft Windows investments. And because the Solaris operating environment is optimized for Pentium® and Pentium® Pro servers, your PC users will have access to information throughout the company faster than ever before. From almost any 32-bit database you're running. It even helps manage your multiple LANs from any single location, and lets you put all your workgroups on the Internet. Easily and securely. To get the study that shows why Solaris is so highly thought of, call us at 1-800-SUNSOFT, prompt #1. For more information see us at http://www.sun.com/solaris/ The solution is well within reach.

SunSoft
THE NETWORK IS THE COMPUTER™

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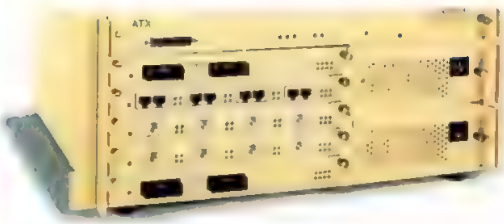
CIRCLE 887 ON READER SERVICE CARD

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Eryn Brown



THE ATX MODULAR SWITCH *rounds out Cabletron's Token-Ring product line.*

Now Switch to Token-Ring

THE PIECES ARE COMING TOGETHER. THROUGH NEW product releases and an acquisition, Cabletron is on the way to assembling a complete, integrated Token-Ring switching line.

The first product in the roll out, the **TSX-1620** (starts at $13,995), is a standalone device available with 8 or 16 ports; FDDI and ATM uplink options will be available soon. The **ATX** (starts at $15,000), a chassis-based modular switch, is the second new offering. Formerly sold by Standard Microsystems, it is also available with modules for Ethernet and other topologies.

Later this year, Cabletron will flesh out the line with switching modules for the **MMAC Smart Switch Series. Cabletron Systems Inc.,** Rochester, NH; 603-332-9400; http://www.ctron.com. *Circle 958 on reader service card.*

A Postscript NIC from DPI

NOW VENDORS WILL BE able to save time and money developing Postscript printers.

Digital Products Inc. (DPI) and Adobe have announced an agreement whereby DPI will build network interface cards that are optimized for Postscript printing. The NICs will incorporate SNMP, status-reporting mechanisms, and other features. **Digital Products Inc.,** Waltham MA; 617-647-1234; http://www.digprod.com.

Adobe Systems Inc., Mountain View, CA; http://www.adobe.com.

NBase Expands Product Line

FAST ETHERNET SWITCHing is becoming a reality. NBase Communications' new **MegaSwitch 100** (model number NH2007 FO), with a base unit selling at $7,995, is targeted at workgroup and midsize networks.

Like the previously released NH2007, the new MegaSwitch has five switched full-duplex ports as well as space for two add-on modules. The NH2007 FO incorporates 100Base-FX ports. Equipped with RMON capabilities, the switch can support up to 2048 MAC addresses.

FOR FAST ETHERNET, *NBase has introduced the NH2007 FO.*

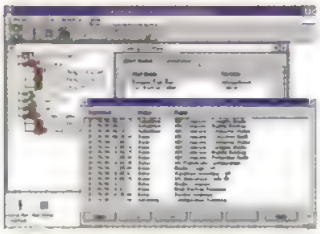
NBase has also introduced the MegaStack family of Fast Ethernet stackable hubs and a new 100Base-TX transceiver for fiber-optic media, the NX3100-FO. **NBase Communications,** Chatsworth, CA; 800-858-7815, 818-773-0900; fax, 818-773-0906. *Circle 957 on reader service card.*

HOT PROSPECT

Palindrome and Windows NT

A smooth setup routine and excellent automation features earned Palindrome's Backup Director an Editors' Choice in our Windows NT–backup review (Network Edition, February 20, 1996). Now the company is shipping two new products that should put more spring in your battle-weary backup administrator's step.

Storage Manager 4.0, Windows NT Edition, provides HSM for Windows NT or mixed Windows NT and NetWare networks. Selling at $1,995 for a single-server license and $3,595 for a multiserver license, the package supplies backup, archiving, and hierarchical storage functions. It works with the Windows NT Registry and with the NetWare Directory Services (NDS), and it includes backup agents for a variety of client and server OSs. Palindrome is also releasing a new version of its centralized storage management console, the **Visual Storage Administrator (VISTA) 1.1, Enterprise Edition.** Like the new Storage Manager, VISTA will work in Windows NT or mixed network environments, consolidating administration for all your Palindrome backup servers. The VISTA Starter Kit costs $1,995.



Palindrome Corp., Naperville, IL; 800-288-4912; http://www.palindrome.com. *Circle 970 on reader service card.*

A Tough Little Black Box

DIGITAL SECURED NETworks Technology's new **Net G-1** (around $5,000 per unit) lets you encrypt your sensitive messages away from the network.

The device is a small black box that plugs into your PC easily and self-configures to its IP or Ethernet address. It uses a hardware- and software-based encryption scheme to secure communications to other Net G-1–equipped machines.

Digital Secured Networks Technology Inc., Ronkonkoma, NY; 516-467-0400; fax, 516-467-4045. *Circle 960 on reader service card.*

TRY FALLING ASLEEP IN THIS MEETING! *Sony's Trinicom 5000 videoconferencing system lets up to three other attendees see exactly what you're up to.*

Sony's 4-Way Conferencing

ANOTHER VIDEOCONFERENCING PRODUCT HAS JOINED the pack: Sony's **Trinicom 5000** system. At $21,500, it's not the cheapest offering on the market, but it does supply one of the widest feature sets, including ready-to-use multipoint capabilities.

The Trinicom is an all-inclusive, roll-about unit that houses the audio/video processor, a high-resolution camera, a 27-inch television, and a wireless remote-control system.

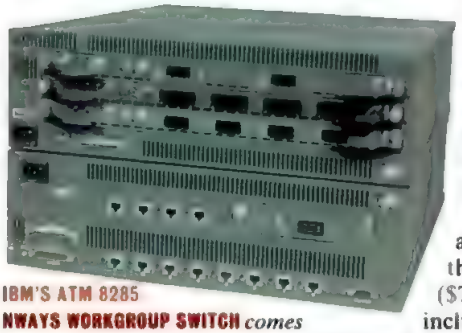
Included in the software are facilities for continuous-presence four-way conferencing, easy dialing, on-screen annotations, and voice-activated switching among windows.

Sony Electronics, Park Ridge, NJ; 800-472-7669; http://www.sony.com. *Circle 961 on reader service card.*

Low-Cost ATM from IBM

IT'S TRUE. FOR THOSE HOPing to get started with a 25-Mbps ATM installation, IBM offers the **ATM 8285 Nways Workgroup Switch** ($6,995).

The switch, specially priced at $495 per user, is especially suitable for small setups of up to 48 ATM clients. You can use it by itself or as part of a larger network that can include high-speed ATM devices. The switch has 12 ports and a single feature slot on the front panel. The slot, which comes with a 25-Mbps ATM port, can be used as a 155-Mbps ATM port. If you want to add an IBM 8260 ATM module, you'll also need to purchase an optional three-slot expansion unit ($3,595). For easy management, IBM has integrated an SNMP agent into the 8285. The command line-driven agent takes care of troubleshooting and other management tasks



IBM'S ATM 8285 NWAYS WORKGROUP SWITCH *comes specially priced for workgroups.*

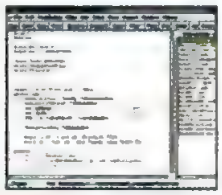
Larger setups also may require the Launch Kit ($76,795), which includes all of the other equipment you need to get up and running—including hubs, servers, clients, and an 8281 Nways ATM LAN Bridge, which lets you link the ATM network to your Token-Ring or Ethernet LAN.

IBM Networking Hardware Division, Research Triangle Park, NC; 800-426-2255; http://www.raleigh.ibm.com. *Circle 960 on reader service card.*

Order Up Some Java

IF YOU'RE ONE OF THE brave few venturing forth into Java programming, you may want to work with TakeFive Software's updated **SNiFF+ 2.2** ($2,090; free upgrade for existing users).

The new suite of object-oriented development tools is available for Unix, Window NT, and Windows 95. It comes with parsers for C, C++, and Java code, as well as browsers and other tools. For applications that require C++ and Java for operation, the suite will work with mixed-language code.



SNIFF+2.2: *Suite deal.*

TakeFive Software Inc., Cupertino, CA; 408-777-1440; http://www.takefive.com. *Circle 963 on reader service card.*

BRIEFS

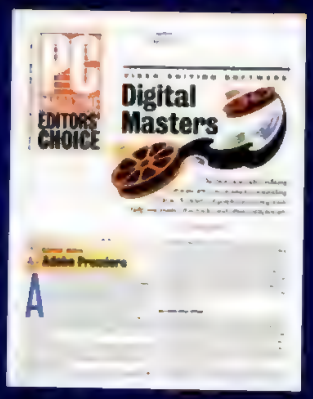
Hardware

For a taste of SMP clustering at a fraction of the usual cost, **CommVision** has enhanced the CommSwitch 2500, its fault-tolerant, multiprocessor unit ($13,495 and up). The box can now accommodate 16 Cyrix 120-MHz 5x86 applications processors. (800-832-6526) ..... **Compatible Systems** has announced availability of the Advanced Microrouter series of Internet access and multiprotocol WAN routers ($1,495 and up). The routers feature dual-Ethernet firewall routing and support T1 and E1 links. (800-356-0283) ..... Like stackable products, **SysKonnect**s new Snap devices—including a hub, a switch, and two SnapLink modules—stack and snap together. Virtually any number of the devices can be combined to build a backbone. The Snap units can also connect to your existing network. (800-752-3334) ..... **3Com** is now shipping a Windows NT security package ($495) for the AccessBuilder 4000 and AccessBuilder 2000 remote access servers. 3Com is also offering four new Fast Ethernet modules for the LANplex switches. (408-764-5000)

Software

The Tun PLUS client/server software from **Esker** is available in a 32-bit version ($395 for a single-user license; $1,695 for five users). It supplies modules for advanced terminal emulation and other features. (415-675-7777) ..... Next time you want to see what's up with your print server, just go to the Internet. **Pacific Data Products** has created the DirectNet Home Page, Web-based print management software. It includes links to the company's Web site and technical-support resources. (619-552-0880)

A GREAT REVIEW IS WORTH REPEATING



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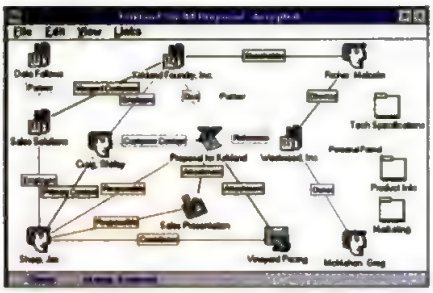
IF YOU'RE TRYING TO CO-ordinate group schedules and contacts, sometimes a PIM isn't enough. Data Fellows' **Vineyard 2.0** stores contact information, word-processing documents, spreadsheets, and other data. It lets you create links among the elements, which are displayed as object/icons, to suit your company's organizational needs.

New features include tools to link to external databases; Vineyard Basic, an object-oriented macro language; and new object types.

Data Fellows Inc., San Jose, CA; 408-244-9090; http://www.datafellows.com. *Circle 962 on reader service card.*



VINEYARD *organizes company info through links.*

Cache = Cash? Try This Out

WHEN WE REVIEWED AIRSoft's **Powerburst 1.0** earlier this year, the caching product worked only with NetWare installations. Tailored to improve the performance of applications running on remote-node PCs, Powerburst uses caching algorithms to eliminate redundant file-system calls.

Version 1.2 (agent, $995; clients, $645 for five users) adds compatibility with Windows NT networks. The release also expands the number of NetWare servers your dedicated Powerburst Agent machine can access to 200. (The earlier product could access only 64 servers.)

The new package also offers automatic upgrade capability. Clients running with the older software will recognize the newer version and initiate an update, without administrator input.

On the client side, users can designate which drives they want to map for caching. They can also specify target apps for performance optimization.

AirSoft Inc., Cupertino, CA; 408-777-7500; fax, 408-777-7527; http://www.airsoft.com. *Circle 959 on reader service card.*

MULTIPLE ACCESS By Steve Buehler

Threat Assessment 101

If you're a good network administrator, you play a lot of roles during your workday. Much of your time likely is spent with the mundane tasks of keeping your network up and your users productive. But sometimes you get the chance to think about network security. I think of this as putting on your "missile cruiser captain" hat: You've got to look outside your flotilla of users, assess the threats and risks, and deploy the proper preventive measures to make sure your charges aren't blasted out of the water. Yet even as you're peering outside, your users are demanding changes inside: virtual private networks, internal corporate intranets, and more remote access. Each carries an increased risk of security failures.

I've recently seen two interesting products that address these problems. If you're concerned about security for users dialing into your network, Paralon Technologies (Bellevue, WA; 800-727-2566) offers the LanKey Secure Remote Access Server. Similar in concept to remote-access servers on the market today, the LanKey offers four dual-slot PC Card sockets for your standard V.34 modems. Drop in a Paralon secure modem, though, and whenever a caller without a known and registered Paralon security device tries to get in, the system denies access. If the user's security device is recognized, the two modems negotiate a secure channel between them with a one-time-only DES key that is never transmitted across the wire. The LanKey (about $6,000, depending on configuration) works under AppleTalk (ARA), Novell's NACS/NASI, and TCP/IP (CSLIP, PPP, and SLIP). The Paralon architecture makes it exceedingly difficult for an outsider to crack into your network.

If you're concerned that someone may be watching what's on your wire and snooping or spoofing your IP traffic, consider a new product from TimeStep (Kanata, Ontario, Canada; 800-383-8211) called Permit. The TimeStep people decided that for minimum user impact they would set up secure DES sessions between correspondents and then scramble only the data within the packet frame. At the network layer, packet headers and trailers are unchanged; only the data section of the network frame is altered, and the legitimate receiver unscrambles it. As with the Paralon, a secure session is created when needed and torn down when done. The advantage of this architecture is that it should be extensible to any data-link protocols (Ethernet, Token-Ring, PPP). One shortcoming is that TimeStep supports only TCP/IP traffic right now. A standard setup consists of a dedicated PC running Permit manager software ($5,000) and software on each Windows for Workgroups client ($99 per client, $149 per remote user). A software and ISA hardware bundle ($219 per client) speeds up encryption and decryption for faster throughput.

Most network-security analysts will tell you that anything one human can build, another can break into. Like the missile cruiser captain, you have to decide which threats are legitimate and which are noise. Only then can you choose the best tools to defend your users from the outside threats while you get back to those mundane network-administration tasks.

ILLUSTRATION BY ROBERT PIZZO

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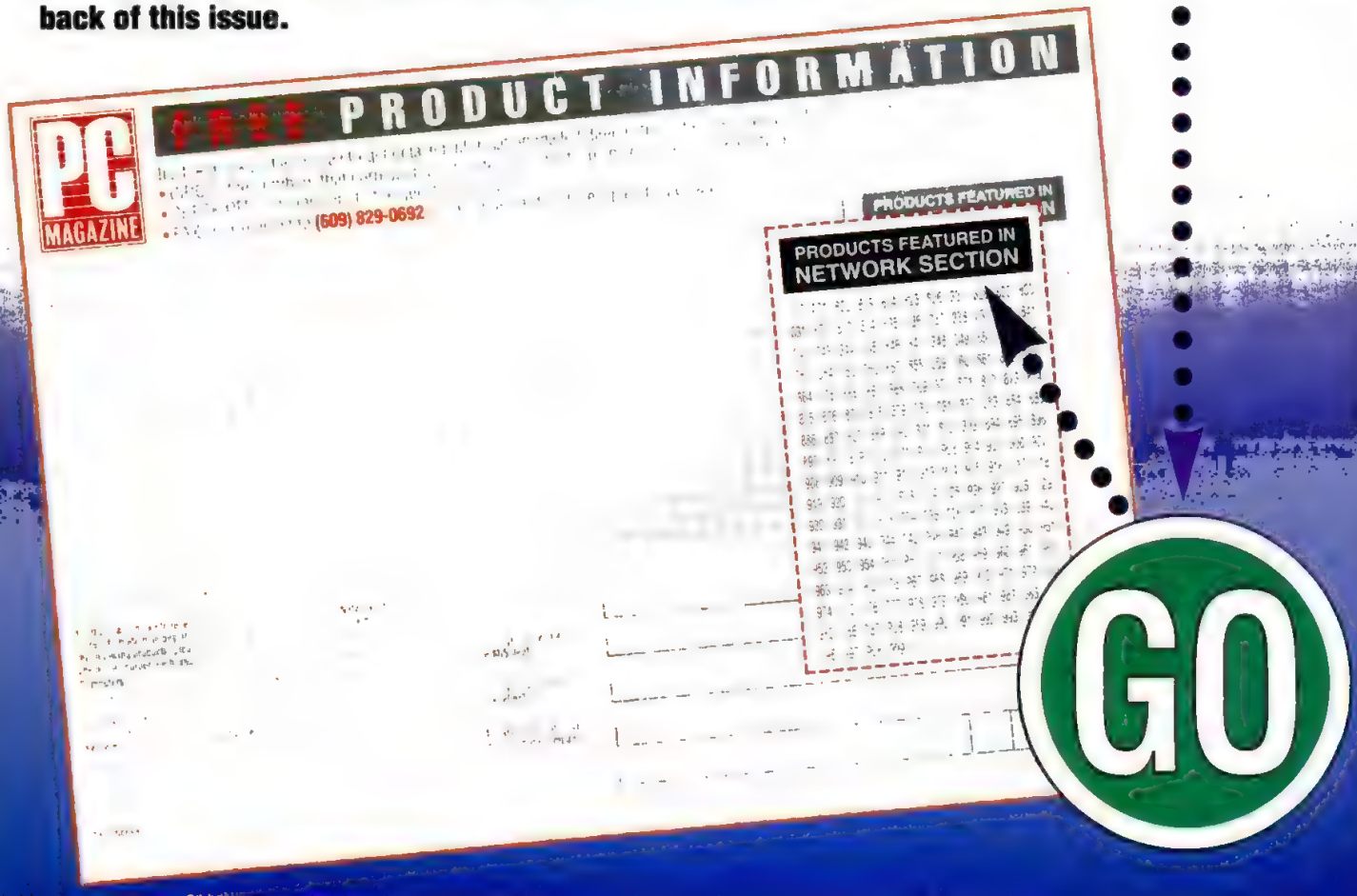

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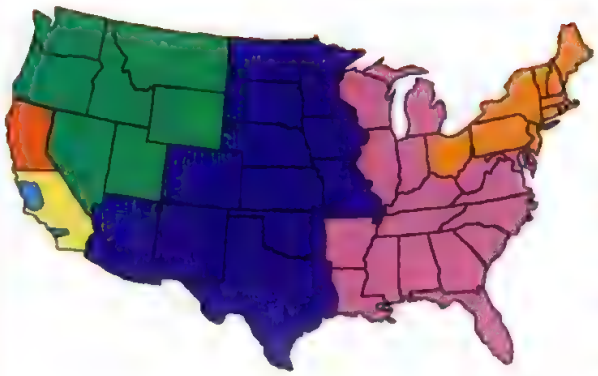

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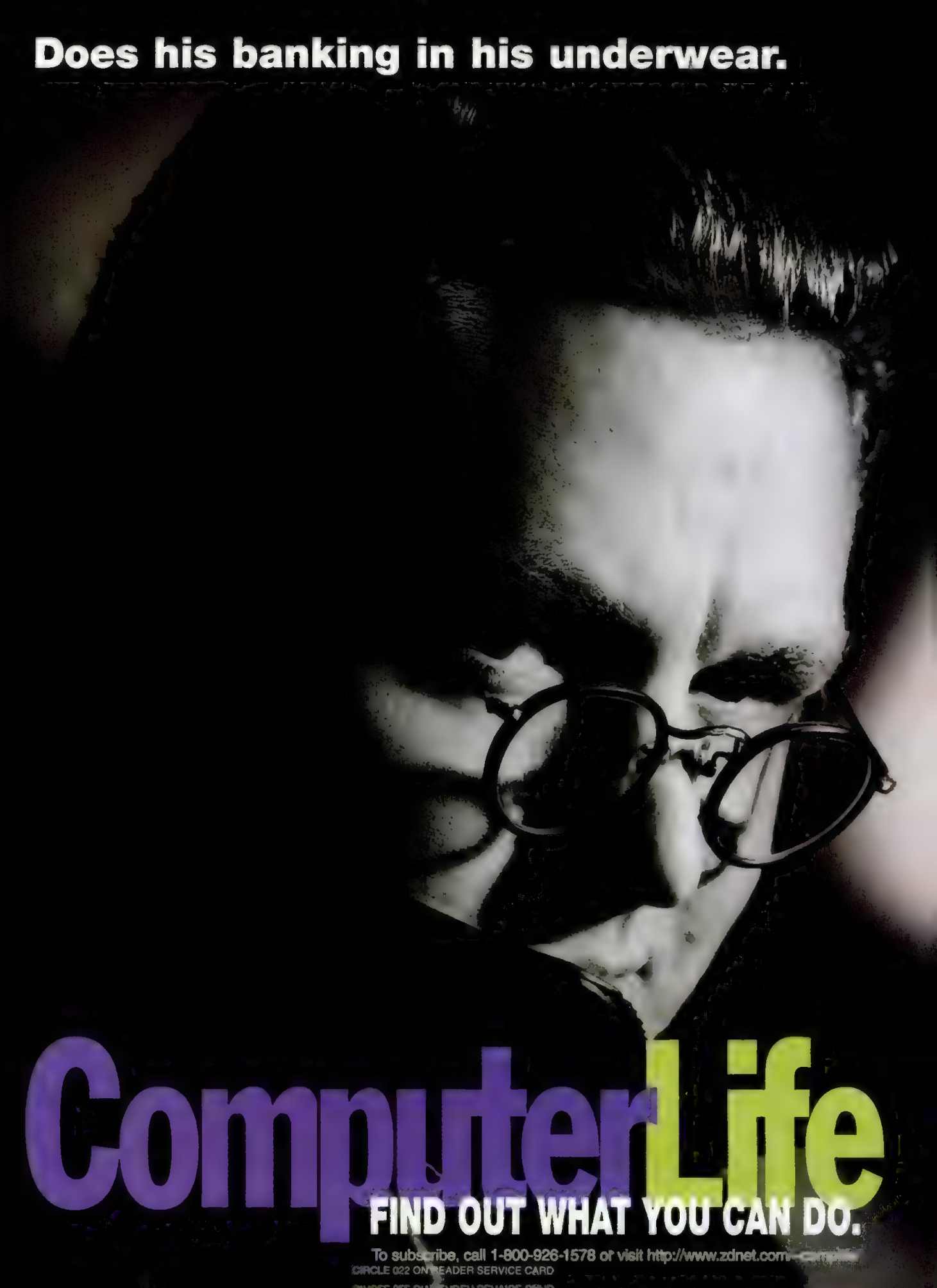
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ILLUSTRATION BY HAYES HENDERSON

Create Your Own CD

By Jim Seymour

The march of technologies and their tools from the fringes of the personal computer universe to the mainstream is one of the great stories of the PC business. Evolving from big, difficult, and expensive undertakings requiring highly trained specialists to small, easy, and affordable tasks you and I can handle as a matter of routine, one computing job after another has come in out of the cold and onto our desktops.

It's happening again, this time with roll-your-own CD-ROMs, or CD-R (*compact disk–recordable*) technology. When Yamaha and Sony introduced the first CD recorders a few years ago, they weren't desktop tools, they were the *size* of desks. Even a year ago, after they'd shrunk to the size of a typical PC system box, CD-R drives were still expensive beasts ($3,000 to $7,500) using expensive media ($30 for a blank disk)—which they trashed with depressing regularity.

Today, for less than $1,000, you can buy a high-quality CD-R drive that fits in a half-height drive bay inside your PC. You can buy name-brand disks for $7 or less. And you'll find software bundled with that drive that makes producing CD-ROMs quick and easy. You may trash a few disks at first, but before long "burning" your own CD-ROM disk (in CD-R lingo) will become routine.

Once the province of CD-ROM professionals, the process of making your own CDs is going mainstream. We show you the hardware and software that makes it all come together.

That said, there are a few tricks to be learned in producing your own CD-ROMs, and the first one is to buy the right drive and software. Accordingly, we've divided this look at the business of making your own CD-ROMs into three areas: the CD-R drives themselves, the premastering software that actually controls the recording process, and the multimedia "authoring" software some users will need for their elaborate CD productions.

BIRTH OF A CD NATION

About 165,000 CD-R drives were sold worldwide in 1995; that figure will grow threefold to half a million drives this year. Why are CD-Rs so hot? It's because of *economy*, *capacity*, and *standardization*. No other widely readable PC data-storage medium compares with the economy of CD-R disks: about a penny a megabyte. (Only digital audio tapes come close, but they are hardly in universal use.)

With 650MB of storage space, CD-ROMs are also big enough to handle backups of most hard disks to just one or two disks—or to distribute a database of literally millions of records economically. Ask anyone who uses one of the CD directories that pack nearly all of the names, addresses, and telephone numbers in the U.S. onto just three to five disks.

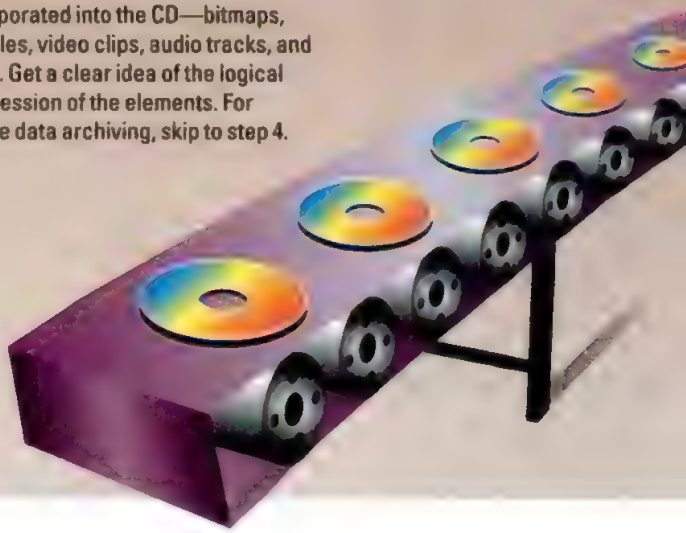
Finally, CD-ROMs are certainly the most universal form of economical, high-density data storage in the world. With about 75 million CD-ROM drives installed on computers around the world—a figure likely to be more than doubled by the end of 1997, according to Jim Porter, editor of the *Disk/Trend* report—it's possible to send a CD-R disk created on your desk nearly anywhere with a high degree of confidence that it can be used without problems.

Though CD-Rs are a lot of fun for home PC users, who can create compilation audio disks of their favorite performers' tracks, they come into their own in a business setting. Beyond conventional uses such as backing up hard disks—making backups, remember, that

Making Your First CD: Six Steps to Success

Creating a CD-ROM from scratch may seem intimidating at first, but by tackling the process a step at a time you'll be churning out shiny platters like a pro.

2. COLLECT or create the various content elements that will be incorporated into the CD—bitmaps, text files, video clips, audio tracks, and so on. Get a clear idea of the logical progression of the elements. For simple data archiving, skip to step 4.



1. DECIDE what type of CD-ROM application you need to make. A buyers' guide? A presentation or training disk? A product demo? Or simply a data archive? This will help you determine whether you need simple mastering software or a full-blown authoring package.

ILLUSTRATIONS BY CALVIELLO & COHEN

are immediately usable without any restoring of the data to an old or new hard disk—CD-Rs allow creation of "audit trail" disks that are unalterable, unerasable snapshots of the state of a set of electronic records as of a given date.

CD-R disks are also coming into wide use as publishing media for companies that want to distribute new, electronic versions of huge illustrated catalogs and price lists quickly. Almost overnight, CD-R systems have grabbed a huge share of the service bureau business; graphic design studios and magazine art directors can replace the dozen 44MB SyQuest cartridges they once sent to their service bureaus on a given job or issue with a single CD-R disk.

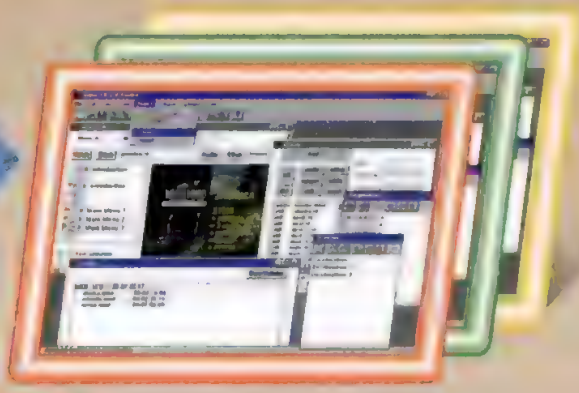
Archiving is another important use of CD-Rs. Network managers regularly comb through large companies' servers for files—and sometimes programs—that haven't been used for a long time. An HSM (hierarchical storage management) system "grooms" those servers' hard disks, moving inactive files from fast but expensive hard disk storage to slower but far cheaper-per-megabyte "near-online" media such as CD-Rs and DATs. You can easily set up your own archiving system on your desktop with CD-R drives. This is far more convenient than moving older, infrequently used data to slow, linear-access back-up tapes, from which the file or files you need must usually first be restored to a hard disk for practical use. (With a spiral recording path, CD-Rs aren't true random-access media, like hard disks, and they're a lot slower than hard disks, but they're plenty fast for direct use of data you access only occasionally.)

FROM READ-ONLY TO WRITABLE

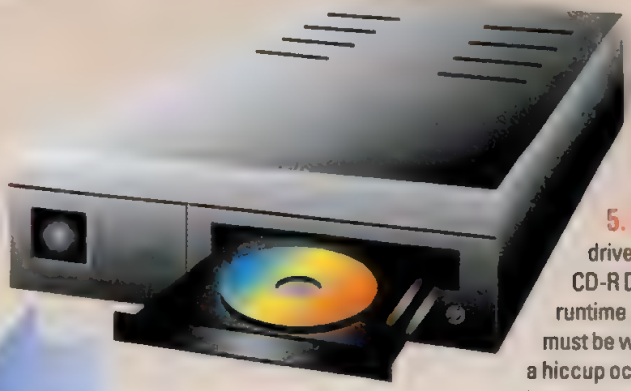
As prices for CD-R mechanisms continue to drop, it's conceivable that PCs aimed at the business user will incorporate CD-R drives in lieu of one-trick–pony CD-ROM drives, since every CD recorder can also read standard CDs. Right now, a typical unit writes at 2X speed but reads at 4X speed (though low-cost units are still only 2X read).

Faster-writing drives are becoming available but may not be worth the price for some time to come, because your batting average in recording disks at 4X or

3. BUILD more complex applications, such as training disks and multimedia presentations, in an authoring package (see "Create Your Own CD: Multimedia Authoring Tools"). You'll create an overview of your entire application and build links between screens, objects, and data. Generate a distributable runtime version of your application, and check to make sure all animations and links perform as expected.



4. IMAGE the files you want on the CD using a premastering package (see "Create Your Own CD: Premastering Software"). Some packages place pointers to the files that should be fetched from the hard disk, while others create an actual mirror image of the data bound for the CD. Most CD-R drives include basic premastering software; more serious applications may require you to buy a full-blown package.



5. BURN the disk on a CD-R drive (see "Create Your Own CD: CD-R Drives"). If you are making a runtime (executable) CD app, the data must be written complete in one pass. If a hiccup occurs and the data stream is interrupted, you'll have to chuck that $7 blank CD and try again.

6. DISTRIBUTE your masterpiece. If you plan on making only a few copies, you can make them one at a time on your CD-R drive. If you want to make a bunch (more than a dozen), it may pay to send a master CD out to a production house for stamping—though you'll need to make sure your CD adheres to certain conventions in the mastering stage.

higher speeds may be low (keep reading). We probably won't see CD-Rs that read faster than 4X for some time, because reading-speed performance is weighed down by the unit's heavy recording head.

MAKING A MASTER PIECE

The drive itself is only half the story. Most CD-R drives come bundled with CD-R premastering software, which lets you arrange and properly format the data to be burned onto a CD. Often, the bundled app is a "lite" version of one of the heavyweight packages reviewed in this issue's story "Create Your Own CD: Mastering Tools."

These scaled-down premastering packages vary widely in terms of ease of use and CD formats supported. The best ones provide intuitive, File Manager–like interfaces for routine tasks such as backup and archiving. Better packages are capable of creating multisession disks, allowing you to add material to the disk incrementally, up to the maximum of 650MB—at the cost of an additional 16MB of overhead space lost with every session after the first. And all are capable of creating both audio CDs (up to 74 minutes per disk) and data disks.

Beyond that, it's not so simple. The world of CD-ROM formats has become confusingly fragmented into a jumble of differing formats. Today you can find not only audio CDs and data CD-ROMs but a bewildering variety of other specialized forms: CD-ROM XA, Photo CD, CD-I (CD-Interactive), Enhanced CD (CD Plus), and more. The lingua franca of the CD-ROM world is the ISO 9660 disk, a data format readable by PCs running DOS or Windows, by Macintoshes running System 6.*x* or 7.*x*, and by almost every Unix variant. You're limited to DOS's eight-dot-three filename, but that's a small price to pay for the ISO 9660 format's interoperability among op-

Our Contributors: JIM SEYMOUR is a contributing editor of *PC Magazine*. JAMIE M. BSALES was the associate editor in charge of this story.

Eight Questions You Always Wanted to Ask About Making Your Own CD

By Jamie M. Bsales

Everyone has at least one skill they are expert in, whether it's installing a hard disk without tools or identifying at a glance the year, make, and model of every car made in the U.S. between 1959 and 1972. But few of us are well versed at making CD-ROM applications. So we've compiled a list of eight of the most common (and most basic) questions PC users tend to ask about this breaking technology.

Can I copy commercial CD-ROMs on my CD-R drive?
Yes, you can, and most of the drive/software bundles have applets expressly for that purpose. There are copyright issues, however. You are allowed to make a copy of a CD-ROM that you bought yourself to use as a backup in case the original gets damaged, but you cannot legally bootleg CDs to give to friends. As for audio CDs, most music publishers' copyright agreements prohibit duplicates even for personal use.

Can I use a CD-R drive to play standard CDs?
Absolutely. But note that the most affordable CD-R drives play at only double speed, and keep in mind also the wear-and-tear factor: You're probably better off reserving the relatively expensive CD-R unit for recording tasks, while using a cheaper CD-ROM drive for your read-only tasks.

How much data can a CD hold?
A CD blank can hold a total of 650MB of information. The amount of data you are able to fit there will be less than that, though, because each session of CD recording "wastes" 13MB of space to open and close each session, and for indexes and the like.

Can I put some data on a CD, then come back a week or month later and add more?
Yes, as long as the drive and mastering software you use support multisession recording, which will allow you to put different recording sessions on a single disk.

Will data archived on a CD last forever?
No. Currently, most media are certified only for a ten-year shelf life. Media manufacturers claim off the record that the data will last well beyond that, and more expensive disk formulations are certified for 100 years. Only time will tell.

Can I use File Manager to drag and drop files to a CD-R drive, just as I would to a floppy disk?
Not yet. Some of the premastering packages work in conjunction with File Manager to let you assemble files to be burned to the CD using that familiar interface. True drag-and-drop recording has been shown in the labs by some major vendors, and may be rolled out this year.

If I find a video or audio clip from a popular movie or the like, can I incorporate it into my multimedia presentation or training CD?
Legally? No. Though it might be tempting to sample Clint Eastwood saying, "Go ahead—make my day," into a presentation, you would be violating copyright laws. You're better off buying a "clip multimedia" package—the multimedia equivalent of clip art—from one of the many vendors (such as Corel) that now offer sets of royalty-free clips you can sprinkle into your CD apps.

How much does it cost to make your own CD?
Blank disks are down to $7 apiece in packs of ten, and even cheaper in bulk. Of course, you have to figure in the expense of wasted disks, especially as you learn the ins and outs. CD recorders with fairly robust software can be found for less than $1,000, and prices will continue to drop.

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CIRCLE 246 ON READER SERVICE CARD

erating systems and hardware platforms. Microsoft's new Joliet CD-ROM formatting standard expands on 9660 by allowing semi-intelligent truncation of long filenames (much as in Windows 95), and it is beginning to be supported by this new generation of CD-R software.

You'll need to learn some new lingo. The most dreaded term is *buffer underrun.* In burning CD-Rs, you get only one chance: Even the slightest interruption of data flowing from your PC to the CD-R drive will spoil the disk, creating a $7 coaster.

To reduce the chances of an interruption, data flowing to a CD-R drive is captured first in a buffer. As long as that buffer is never fully emptied—picture data from the PC's hard disk being poured into the top of a bit bucket, while data added earlier is being drained off at the bottom to the CD-R—you won't have problems. But even the briefest gap in that data flow—a buffer underrun—and you're headed back to the starting line to buy another $7 ticket. See the accompanying roundup on CD-R drives for details on how frequently (or infrequently) each drive/software combination had us swearing under our breath.

If you're interested in using CD-R for publishing, you'll want to look closely at the economics of producing multiple-copy runs. In general, desktop CD-R production makes sense for up to 12 duplicate disks. It isn't just the $7 cost of blank CD-Rs that limits the size of most desktop runs, but the cost of labor—and, often more important, the delay in completing the job and getting the data out the door. On the one hand, you can crank out a few dozen disks in less time than it takes FedEx to get your CD-R master to a CD-ROM duplicating plant. On the other, one-at-a-time processes don't lend themselves to much speed.

If you decide to go for larger runs, you'll be happy to know that your desktop-produced CD-R will be happily accepted by most CD-ROM stamping plants. However, as in any service-bureau relationship, make sure you understand the supplier's requirements, and—long before you send a disk by overnight courier for a hurry-up job—send a sample master created on your system, for testing. For mass duplication, it's critical that such things as start and stop codes, track numbers, and "post gap" timing be correct.

BEYOND BACKUP

Similarly, make a realistic assessment of the level of sophistication you want in your CD-Rs—and your own skill and interest level. It's easy to create a PowerPoint 7 presentation on your PC's hard disk, then transfer that show, with accompanying sound and video files, to a CD-R for wider distribution. But as you'll see in our accompanying review of multimedia authoring packages, creating a dazzling true multimedia CD akin to those shrink-wrapped CD-ROMs on store shelves is a world beyond the simple content-creation tools we're used to using (such as word processors or charting and graphics programs).

Today's best multimedia authoring software is much better than the programs we examined two years ago. As a class, these apps now handle video clips and CD-quality audio with aplomb, making the creation of truly interactive apps much easier, and no longer demand a programmer sitting at your elbow for satisfying results. But there's still a learning curve to climb, and none of these packages are suitable for the casual user. Are they right for you? Put another way: do you really want to change your job title to Multimedia Writer/Artist/Designer/Producer?

What's New Online

From March 25 through March 29, learn how to use multimedia authoring packages to create your own CD-ROM applications. Reviewers Linda and Erick Von Schweber will be online to answer your questions in *PC Magazine*'s Editorial Forum on Compuserve (GO PCMAGNET).

Also from March 25 through March 29, visit *www.pcmag.com* and join in a discussion with contributing editor John R. Quain, talking about CD-R drives and premastering software.

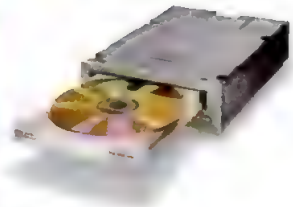
MORE ACRONYMS TO FOLLOW

Today's CD-R drives are amazing bargains. Later this year we'll see prices fall from today's low of just under $900 to about $500. Beyond that? At the last Fall Comdex, Philips and Ricoh showed prototypes of their new CD-E (*compact disk–erasable*) products. As the name implies, the disks will be rewritable (and hence reusable), just as floppy disks are today. Philips hopes to ship final units by the fourth quarter of this year. The drives and disks will be backward-compatible with today's CD-ROMs and CD-Rs, and will command a small price premium over their write-once precursors.

The other optical-disk sensation this year is sure to be the DVD (which once stood for *digital video disk* and then *digital versatile disk,* but which now has no official long name), agreed on last fall over competing and naturally incompatible technologies advanced by Sony and Toshiba. This year's DVD units will hold 4.7GB of data—enough for a feature-length movie, with MPEG-2 compression applied—and will be able to read existing CD-ROM and CD-R disks. Consequently, a single DVD disk could hold, say, the complete movie *The Lion King* for home DVD players, as well as Disney's related computer game for PCs, the sound track from the movie, and a complete catalog of Disney products. The DVD specification also allows for double-layered disks with a total capacity of 8.5GB and the potential for double-sided, dual-layer disks with a 17GB capacity. Unfortunately, none of these new disks will play in today's CD-ROM drives, but new DVD drives for PCs may be on the market as early as the end of this year.

Will recordable DVD disks be far behind? There are already plans on the drawing board for so-called DVD-R disks. However, industry experts don't expect the 3.8GB recorders to arrive on the market until the end of 1997 at the earliest, and probably not until 1998.

Our advice: If the convenience and power of quick, easy production of cheap 650MB optical disks that can be read on many millions of PCs across the world appeals to you, dig in. On the pages that follow you'll find everything you need to know to put CD-R tools and technology to work on your desktop *today*.



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- *Store up to 650 MB of data or 74 minutes of audio*

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CD

CREATE YOUR OWN

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ILLUSTRATION BY HAYES HENDERSON

Cover Story

CD-R Drives

By John R. Quain

Just as new HTML software threatens to turn every PC into a World Wide Web site, lower-cost compact disk–recordable (or CD-R) drives look poised to turn every desktop into a CD-ROM publishing house. When the first CD-R drives were introduced about six years ago, they cost as much as $25,000. By the end of last year, prices had dropped to around $2,000. Now, several of the 19 CD recorders in this roundup can be picked up for less than $1,000—and prices continue to plummet.

Of course, you can always pay more, and there are CD-R packages here aimed at professional CD-ROM developers costing well over $3,000. What you get for extra money is a faster recorder (quad speed versus double speed), better software, and more hand-holding from the vendor.

No matter which model you choose—an inexpensive package for archiving valuable data or a high-end model for developing the next Myst—all the CD-R drives work on the same basic principle. To make CD recordings, the drives use blank CDs that can hold up to 650MB of data, or about 74 minutes' worth of audio. Each disk contains a reflective layer of gold and a layer of organic dye. A laser in the CD recorder embeds information on the disk in a series of pits by melting the green-colored dye layer at the appropriate spots. Known as *burning*, this process creates a CD that can be played in any standard CD-ROM drive.

As compact disk–recorder prices spin lower, more PC owners' heads are turning. There's a package to fit your needs, from backups to multimedia applications.

REVIEW CRITERIA

For this roundup, we acquired CD-R subsystems (drive and software) commercially available in the U.S. as of January. We set a price cap of $3,500 in order to include both entry-level and professional systems. This netted 19 CD-R packages from 17 different companies. Street prices range from $850 for the Pinnacle Micro RCD 5020 to $3,495 for Pioneer's quadruple-speed DW-S114X. Models that did not make it in time for review included ones from Creative Labs and Parallel Storage Solutions.

The CD-R drives we tested rely on drive mechanisms from seven different manufacturers: JVC, Olympus, Philips, Pioneer,

Ricoh, Sony, and Yamaha. Six of the packages use 4X-read/4X-write mechanisms made by Pioneer and Yamaha. The rest are double-speed recorders, three of which—the Hewlett-Packard, Philips, and Plasmon models—could read disks at quadruple speed.

Although some of the reviewed packages were a cinch to set up—most notably Optima Technology's DisKovery 650 CD-R ($1,650 list) and Sony's Spressa ($1,495 list)—more often than not we spent days toiling with convoluted software setups and working our way through innumerable false starts before we were able to burn CDs confidently and without trouble (see the photo on the right). So read the reviews carefully. Few of these CD-R bundles are ready for overworked business users who don't have time to waste on technical-support calls.

Try, try again—and again: These stacks of wasted disks prove that making your own CD takes practice.

IT'S THE SOFTWARE, STUPID

Integral in the life of a CD-R drive is the particular premastering software package it uses. For example, most of the CD-R drive mechanisms can record Photo CDs, but most of the bundled software can't support such recordings. Two notable exceptions are the JVC Personal Archiver and the Smart and Friendly CD-R 4000/Pro. They were the only products able to complete all of *PC Magazine*'s tests successfully.

Even though most of the CD-R drives use similar mechanisms, we discovered that their performance varies widely, from about 15 minutes to over an hour to copy 280MB of files. Much of this difference is also due to the software used with the drive.

How the software handles directory creation, file pointers, buffering, non-standard filenames, and data throughput can radically affect the total time it takes you to make a CD. For example, Yamaha's CDR100—a 4X drive—with Incat's Easy-CD Pro software produced one of the best times on our On-the-Fly Recording test: about 15 minutes. When we used the same drive with Corel CD Creator, however, it took nearly 30 minutes to complete the same task.

Furthermore, the software can make a substantial difference in how easy or difficult it is to make recordings. That's because the software is responsible for guiding you through the process of putting files in an efficient recording sequence, managing data and digital audio tracks, calculating the storage space required, and determining the optimal recording speed. CD-Rs must burn information to a blank disk in a steady data stream. Using the drive's on-board buffer (usually 512K or 1MB), data is cached to keep up with the recording. When the data stream falls behind the laser doing the burning, your recording is aborted—and the blank disk wasted—because of a so-called *buffer underrun*. How often this happens depends on how adroitly the software handles the data, as well as how quickly the system you are using transfers the data.

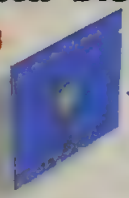
We encountered such errors many times during the course of testing. To avoid such problems, we recommend that you always use the software's preburn data throughput diagnostics. It adds an extra step, but you'll save money on media.

A majority of the drives we tested included either Corel CD Creator for Windows 3.1, Incat's Easy-CD Pro for Windows 3.1 (or the Windows 95 version), or Elektroson's GEAR MM. By far the easiest to master was Corel's program. Unfortunately, in its Windows 3.1 incarnation, Corel CD Creator lacks some features that professional CD-ROM developers may deem necessary, such as the ability to create an image of your recording on a hard disk. A *physical image file* comprises all the files you intend to record in the precise order that they will appear on the disk (as opposed to a *virtual image file*, which is merely a set of pointers to the files). The advantage of having a physical image is that you can test it before actually making a disk.

After *PC Magazine*'s testing was complete, however, Corel released CD Cre-

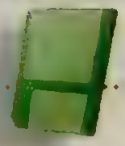
Data-Distribution Time Line: From Oxide to Gold

1978



5.25-inch floppy disk
A smaller sibling of the 8-inch ferromagnetic disks used on mainframes, the 5.25-inch disk debuts in the first mass-market PC. The disk can hold 100K of data, a capacity that would eventually increase to 1.2MB.

1987



3.5-inch floppy disk
With hard-shell cases and protective covers shielding the media, 3.5-inch floppy disks are more robust than their predecessors and eventually replace them. Capacity reaches 1.44MB, but as application and file sizes grow, this distribution medium becomes increasingly less convenient.

1990

CD-ROM
This format gains visibility in the PC arena after compact disks render vinyl LPs all but obsolete in the consumer audio market. The disks cannot be written to, but with 650MB capacity and the near-universal acceptance of the drives on PCs, they are far superior to floppy disks for read-only tasks.

1996

Compact disk-recordable
Affordable and easy-to-use CD-R drives finally trickle down to the mainstream. Business users and multimedia developers can have CD-ROM creators right on their desktops to archive data and distribute custom-made CD-based applications.

ILLUSTRATIONS BY DAVID FOSTER

Personal backup and archiving:

Smart and Friendly CD-R 1002/Pro

Corporate data distribution and application mastering:

Smart and Friendly CD-R 4000/Pro

If there's one thing we learned about the CD-R drive bundles currently on the market, it's that none of them is perfect: Not one of the 19 subsystems we reviewed mustered a score of *excellent* on all four of the tasks we deemed most important to business users. But while none were flawless, seven came close enough to warrant Editors' Choice or an honorable mention.

For the individual PC user looking for an affordable entry into the arena of CD-ROM creation, the Smart and Friendly CD-R 1002/Pro is a solid package worthy of our Editors' Choice distinction. The $1,099 street price (probably lower by the time you read this) gets you a 2X-read/2X-write Sony drive mechanism plus all the incidentals, including an Adaptec SCSI adapter and Incat premastering software. True to its name, the Easy-CD Backup utility makes backing up data to CD a snap. If your primary tasks will be backup and archiving but you plan on dabbling in more advanced CD creation, the CD-R 1002/Pro should fit your needs and budget.

PC MAGAZINE EDITORS' CHOICE

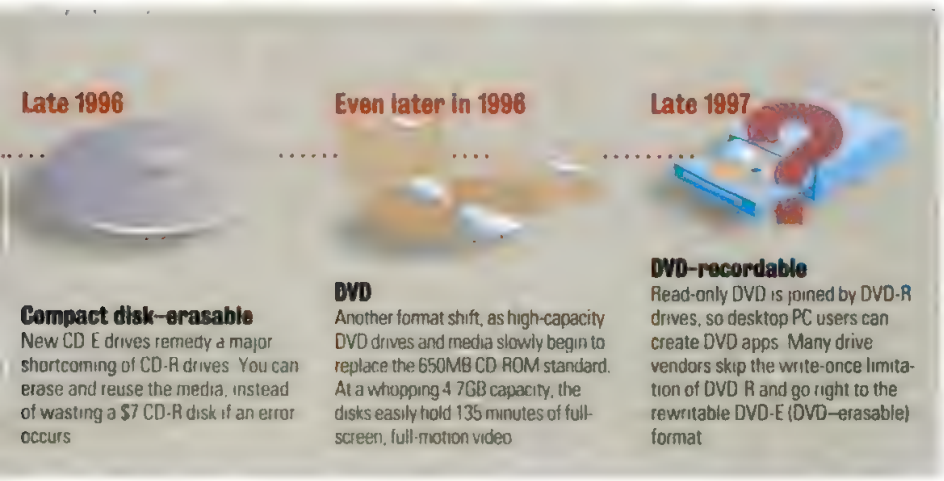
For jobs like daily archiving, multimedia presentations, data distribution, and application creation and distribution, consider one of the more robust professional-level packages on the market. Our Editors' Choice here goes to another Smart and Friendly bundle, the CD-R 4000/Pro. This $1,799 package delivers the same software and extras as its less costly stablemate but replaces the Sony drive with the excellent Yamaha 4X-read/4X-write CDR100 mechanism. Much to its credit, this bundle was one of only two we reviewed that were able to complete all our rigorous recording tasks, including the creation of Enhanced CD– and Photo CD–formatted disks.

Budget-minded users who need speed and ease of use should consider Sony's Spressa bundle ($1,300 street), which warrants an honorable mention. Those needing primarily a backup and disk-duplication solution should consider one of our other honorable mentions: the HP SureStore CD-Writer 4020i ($1,000 street), Philips CDD2000/20 ($1,100), or Ricoh RS-1060C ($875). All will prove adequate for less demanding chores and inviting to novice users—at very attractive prices.

Finally, another honorable mention goes to the antibundle bundle from Yamaha. The company ships its reliable and quick quad-speed reader/recorder, the CDR100, without software. VARs and retailers are then able to bundle it with any of the major premastering software packages (usually for about $1,495 on the street), so users of all levels can get the bundles that best fit their needs.

ator 2.0 for Windows 95. In informal tests, the software proved much more flexible than the Windows 3.1 version, incorporating additional features such as enabling us to create image files as well as Kodak Photo CD disks. Several of the hardware vendors planned to offer newer Windows 95 software bundles with their systems by the time you read this, so make sure you check the vendors' current lists of supported features.

If you need total control over your CD recordings, you may want to consider buying a separate software package. Some of the drives here, such as the Yamaha, come with no software at all, while others like Micro Design International's Express Writer offer only basic software for archiving. So if you plan to create serious multimedia CD-ROMs, you may want to consider purchasing a more sophisticated program that's compatible with one of the recorders in this review. Separate CD recording packages are expensive—ranging from a couple of hundred dollars to several thousand dollars—but they can give you better control over your recordings. (See the story "Create Your Own CD: Premastering Software" elsewhere in this issue.)



FORMAT SOUP

To decide whether a given package offers everything you need, check what kinds of disks you can burn with the software. So that you don't get lost among a host of inscrutable and often equivalent acronyms used to describe different disk formats, there are a few major formats you should be familiar with.

Red Book is the standard originally developed by Sony and Philips for audio compact disks. This format was then expanded

to accommodate computer data (with additions such as extra error-correction codes). The earliest CD-ROM disks used this new *Yellow Book* standard. Yellow Book does not include any sophisticated multimedia features, but if you need your disk to be readable by every CD-ROM drive ever made—including the older 1X single-session drives—you need to create a disk that adheres to Yellow Book. All the drives in this roundup can write this format.

Yellow Book has been largely superseded by the *CD-ROM XA* format. This standard allows you to interleave data and audio, which lets developers produce the multimedia titles we have grown accustomed to. All of the drives in this roundup also support CD-ROM XA recording.

The newer *multisession Photo CD* format was originally developed by Kodak for putting photos on compact disks. While Photo CD also describes a digital image storage format, it is of primary importance now because it allows you to create multisession disks that maintain a single, complete table of contents. You can keep adding data to a disk over time and have one coherent index of what the disk contains, rather than creating several indices on what appear to be several different volumes. About half the bundles here support multisession Photo CD.

Enhanced CD (also known as *CD Plus*) is a new format specifically designed to enable music CD producers to include data and graphics (such as liner notes and lyrics) on a conventional audio CD; CD Plus disks are also referred to as a mixed-mode disks because they contain both Red Book audio and standard data tracks. The CD Plus specification is in its final draft stage, and several music CD manufacturers are already using it. Direct support for the format has already been included in Windows 95. Only two of the drives we tested were able to lay down tracks adhering to the CD Plus specification.

In addition to these common disk formats, there are a host of others you may see listed for some products. *Orange Book*, an extension of Yellow Book, allows for multisession recordings. *Green Book* was established for CD-Interactive (CD-I) disks used in home entertainment players. CD-I is Philips' proprietary format, and if you plan to make recordings for CD-I players, you'll need special software tools to do the proper data and audio interleaving. Finally, *White Book* is a standard that lets recordings made in this format work in both CD-ROM XA and CD-I players. It is mainly used for disks that offer full-motion MPEG video.

FINAL CHECKLIST

Armed with all this information, you should be able to find the CD-R package that matches your needs. But before you go and plunk down $1,000 or more for the bundle of your choice, there are some additional items you may need before you start setting up your own CD-ROM publishing house.

First, consider buying a 1GB hard disk. Although most PCs now come standard with 1GB or larger hard disks, you may want to add another one if you plan to create disk images on your hard disk before you burn a CD. An image file will take the same amount of storage space as the CD recording itself, up to 650MB. Add to that a temporary directory needed by the software and you'll quickly run out of hard disk space.

Check to see if your system has a bus-mastering SCSI controller. Many of these packages don't include an adapter card but will work with a variety of SCSI adapters. Make sure yours is a bus-mastering model to help ensure adequate performance of the CD-R subsystem. Also make sure you pick up a SCSI cable if you're buying an external drive. This is a minor concern, but any drive that doesn't come with an adapter usually also lacks a SCSI cable to hook it up to your system.

Finally, plan to spend an additional $100 or so on extra blank CDs (which currently run $7 apiece in bulk). Most of the drives reviewed here come with only one blank disk, so budget accordingly. By preparing your system and poring over *PC Magazine*'s reviews, you'll have a much easier time burning your own CDs.

HIGHLIGHTS

Make Your Own CDs

There are many reasons to want the ability to burn your own CDs. Businesses can archive information and easily reproduce it for all employees in a convenient form. Hospitals possess the capability to store numerous patients' health charts on one simple disk. And if you've ever wanted to be a singer in a rock-n-roll band, here's your chance. With some CD-R drives costing as little as $1,000, dreams of fame (or merely an organized office environment) are literally at your fingertips.

BURNING DESIRE Integral in the life of a CD-R is the software package it uses. How the software handles directory creation, file pointers, buffering, non-standard file names, and data throughput tests can radically effect the total time it takes you to make a CD—often masking any performance difference you may seek to gain between a double-speed and quad-speed drive.

DON'T GET BURNED The software can determine how difficult or how simple it is to make a recording. The software is responsible for guiding you through the process of putting files in an efficient recording sequence, managing data and digital audio tracks, and calculating the storage space required and the optimal recording speed. When the data stream falls behind the laser doing the burning, a buffer underrun occurs and your recording is aborted.

BURN, BABY, BURN Now that you've studied the manuals, chosen the software to suit your needs, managed to hook the SCSI adapter up to your PC, and gathered all the files that will comprise your disk, you're ready to burn. There are a few last items you should check off your "to do" list: consider buying a 1GB hard disk. Make sure that your system has a bus-mastering SCSI controller. Then, check your pocketbook for spare change. Blank disks are usually not included with the bundles.

Our Contributors: JOHN R. QUAIN is a contributing editor of *PC Magazine*. HOLLY AGUIRRE is a staff editor and DENIS TOM is a technical analyst at *PC Magazine*. MICHELLE SCHOENUNG is an editorial researcher at *PC Magazine*. BRUCE BROWN and M. DAVID STONE are contributing editors of *PC Magazine*. JON HILL and JAMES KARNEY are frequent contributors to the magazine. JAMIE M. BSALES was the associate editor in charge of this story, and JEFF MACE was the project leader.

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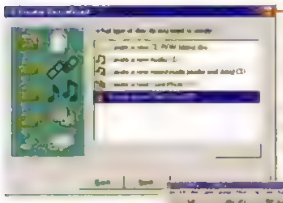
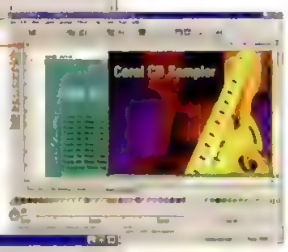
The Best in 32-Bit CD Creation

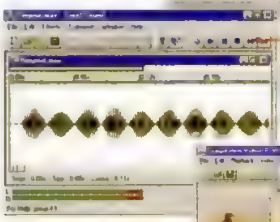
"It's the easiest CD-R mastering application to learn & use."
InfoWorld, January 8, 1996



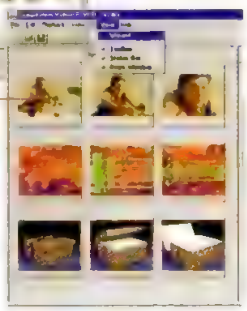
Corel CD Creator 2's **Disc Wizard** demystifies the CD creation process. This Wizard allows the first time and infrequent user to create CDs with little effort



Open CorelDRAW™ 6 or other Windows® 95 OLE 2.0 graphics applications within Corel CD Creator 2 to edit images for **jewel case inserts.**



Audio can be edited using the new 32-bit **Corel SOUND** application



Corel VCD Creator allows users to select videos and stills from various sources and produce a video CD

Also includes:

- **Corel PCD Creator** - Display and select PCD images that are then written to a CD.
- **Corel CD Duplicator** - Allows you to easily duplicate CDs.
- **Corel Session Selector** - Enables you to select any session of a multisession disc.
- **XingMPEG™ Software** - Includes XingMPEG Encoder™ and XingMPEG Player™ software for video CD. Encoding boards are not necessary, but can be used if available.

Easy to use!

- Context-sensitive Help
- Support for Enhanced CD

Corel® CD Creator 2 Beats Incat Easy-CD Pro™!

FEATURES:	Corel $249*	Incat $499*
VCD + AUTHORING	Y	N
PCD CREATION	Y	N
CD +	Y	N
DISC DUPLICATION	Y	N
AUDIO DISCS + CDDA EXTRACTION	Y	Y
AUTOMATIC SYSTEM CONFIGURATION	Y	N
DISC CREATION WIZARDS	Y	N
JEWEL CASE + CD ARTWORK CREATION	Y	N
FULL MULTISESSION/MULTIVOLUME SUPPORT	Y	N
MULTISESSION SELECTION UTILITY	Y	N
ADVANCED + BASIC FILE OPTIMIZATION	Y	N
MULTITHREAD FILE OPTIMIZATION	Y	N
FULL MULTITASKING	Y	N
MINIMUM TEMP HARD DRIVE SPACE REQ. RED	Y	N
AUDIO EDITING	Y	N

Watch for Corel CD Creator 2 to be bundled with the following CD-Recorders:

PINNACLE MICRO
#1 in Recordable CD Systems
800.553.7070 • 714.789.3000

PHILIPS
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SONY
Spressa™ Recordable CD-ROM (CD-R) Drive
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KUR-0222

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Document # 1015

*US$ plus applicable taxes and shipping. †Suggested list price. Dealer may sell for less.

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DynaTek Automation Systems Inc.

DynaTek CDM400

The Dynatek CDM400 ($2,499 list, $2,299 street) combines top-quality components, but the whole proved less than the sum of its parts. The fine 4X-read/4X-write drive mechanism (from Yamaha) is up to any task a CD-ROM professional or heavy-duty corporate user could throw at it, but this bundle is hampered by the software. At the time of our testing, DynaTek included DiscMaster recording software—essentially a relabeled version of Elektroson's GEAR MM. Although the software is easy to use and versatile enough for simple tasks, it was unable to complete major portions of our rigorous testing script successfully. The company plans to bundle Incat's Easy-CD Pro as an option in lieu of the DiscMaster software. In the meantime, it's difficult to recommend the CDM400 as configured.

The CDM400 bundle begins with an external Yamaha CDR100 CD recorder, a capable midrange workhorse with a 512K buffer. The basic package comes with a SCSI terminator but does not include a SCSI controller card or cable.

SUITABILITY TO TASK

	Power	Ease
Initial startup	Good	Fair
Backup	Fair	Fair
Disk duplication	Fair	Fair
Format flexibility	Poor	Fair

Although the DiscMaster software (née GEAR MM) was the source of most of the CDM400's problems, it does contain several valuable features. The software begins by opening three separate windows: Windows' own File Manager, the contents of the current working image, and a scrollable Status window that contains information on the current image and logged results of every action undertaken in the current session.

DiscMaster's Estimate process doesn't simply predict whether a prospective image will lead to a successful burn—it loads the status window with sector-by-sector reports on your source's transfer ability. Unlike several of its competitors, DiscMaster does not currently set aside an area on the hard disk for use as a supplemental buffer. We were unable to back up a set of directories containing roughly 15,000 files at 1X recording speed from the virtual image, even though the same Yamaha CDR100 drive was able to complete our On-the-Fly Recording test at a speed of 4X when combined with Incat's Easy-CD Pro. Worse, when we tried to create a Photo CD multisession disk from a virtual image, the software caused a GPF whenever we tried to append more than 15 files to the first session.

If you have enough free disk space (roughly 680MB), you can create a physical image file on your hard disk and burn the CD from the physical image. When used in this fashion, DiscMaster worked fairly well. The drive successfully created the 15,000-file CD at its rated speed of 4X.

DiscMaster can use externally created physical ISO images, and it can create an image file from a previously recorded CD, so we were able to copy audio tracks and complete audio CDs and CD-ROMs with-

CD-RECORDABLE DRIVES MANAGERS

How to Read the Suitability to Task Boxes

The majority of users will need only to record simple backup and archive files, as well as make duplicates of store-bought audio and application disks (for personal use, of course). More complex tasks will require a more sophisticated bundle able to record in a wider range of multisession formats

If a CD-R bundle is to appeal to the mainstream, the **initial startup** should be as hassle-free as possible. The best packages include everything you will need right out of the box—SCSI adapter board, robust software, blank CDs, and excellent documentation (that covers both the drive and software, as well as providing guidance about the various CD-ROM formats). The drive should offer a variety of setting options to coexist with your already installed peripherals. Better bundles also let you pretest your system to check for optimum configuration, and provide cogent guidance should you run into a snag

SUITABILITY TO TASK

	Power	Ease
Initial startup	Poor	Poor
Backup	Fair	Fair
Disk duplication	Good	Good
Format flexibility	Excellent	Excellent

To be rated as an excellent **backup** device, a drive must support single-session and CD-ROM XA multisession recording. It should record error-free at 2X speed at least, and show performance on a par with other drives in its class. Ease-of use-concerns include a flexible, intuitive user interface (preferably similar to the familiar File Manager interface), an understandable way of selecting from among the CD-ROM format choices; a way to manage ISO rules violation issues (such as automatic conversion of nonstandard filenames to conform to the ISO 9660 specification); and strong on-line help and printed documentation

The rating for **disk duplication** indicates how well a bundle is able to duplicate audio and computer CDs The more powerful bundles let you read audio from a Red Book audio CD and write in that format onto a blank disk, and they can also copy CD-Plus disks Easy-to-use bundles help you create a "track list" (preferably from multiple sources) of the tracks to be included, and let you record on the fly. The software should also have a straightforward disk duplication option, and allow you to perform a verify-before-write to guarantee a perfect clone of the master

Format flexibility separates the limited, entry-level bundles from their professional-caliber counterparts. To earn a rating of *excellent*, a package must be able to write the more advanced multisession CD-ROM formats, including Photo CD and Enhanced CD (CD Plus) Better bundles also take the guesswork out of creating higher-level CDs by not burying important user options beneath convoluted multilayer menu structures

out incident. The package does support several advanced formats, including CD-Interactive and interleaved CD-ROM XA, though we consistently ran into a software error when we tried to create Enhanced CD (CD Plus) disks.

All in all, working with the Dynatek CDM400 was a frustrating experience. The 4X Yamaha CDR100 mechanism is certainly alluring, but until the software component in the current bundle is either revised or changed you're probably better off elsewhere.—*Jon Hill*

DynaTek CDM400. List price: $2,499. DynaTek Automation Systems Inc., Bedford, Nova Scotia, Canada; 800-267-6007 (U.S.), 800-461-7078 (Canada); fax, 902-832-3110. *Circle 444 on reader service card.*

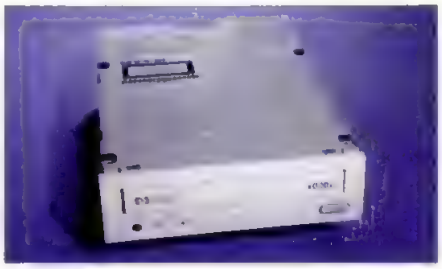
Hewlett-Packard Co.

HP SureStore CD-Writer 4020i

The HP SureStore CD-Writer 4020i is a bargain among CD-R drives. Aimed squarely at the budget-minded, small-volume user, this $1,249 kit (about $1,000 on the street) includes a 4X-read/2X-write drive, a special AdvanSys ISA host adapter, and a suite of basic authoring, indexing, and viewing applications. Produced by Hewlett-Packard's Colorado Memory Systems division, long known for mass-market tape drive kits, this offering has few frills. But while the 4020i may not meet every need, the price/performance ratio hits the mark.

The internal drive has just basic controls on its front panel: an eject button, volume knob, headphone jack, and lights for power and operation. It is based on Philips parts, using a tray rather than a caddy design.

If you plan on using a third-party adapter rather than the included AdvanSys model, think again. To maintain a consistent test-bed for all the machines, we tried to hook the drive up to our Adaptec AH-2940 card. Since the installation routine looks for the bundled card, some workarounds and manual settings were required to get things running, much to our chagrin. And when we finally did get it running, performance was poor (thanks to a



SUITABILITY TO TASK

	Power	Ease
Initial startup	Good	Fair
Backup	Excellent	Good
Disk duplication	Fair	Good
Format flexibility	Good	Good

DMA conflict between the supplied adapter and the rest of the system settings), and buffer underrun errors were plentiful.

Setting up the drive with the bundled host adapter, as most entry-level users would, is hassle-free. With the 4020i mounted on its own card (and with our hard disk and a Plextor 6X CD-ROM on the 2940), performance picked up dramatically and the buffer underruns stopped. The backup-related tasks in our test suite were executed in good time, especially for a 2X recorder: The drive completed the On-the-Fly Recording test in just under 28 minutes.

HP ships the unit with a custom edition of Incat's Easy-CD; you also get Easy-CD Audio, Incat's Magic Lantern for viewing Photo CDs, and IMR's Alchemy personal indexing package. The products operate only with Windows 3.1, but HP says Windows 95 versions are under development.

Creating backup sets of data on the fly was easy using Easy-CD: Choose the files, run a speed test if desired, and burn the disk. The Alchemy indexer is a nice touch, allowing you to produce full text databases with simple-to-use queries and the ability to run right from the new CD-R platter. Audio creation is less elegant, since Easy-CD Audio will work only with existing .WAV files. Hence, we could not directly copy tracks from a music CD. The Magic Lantern Kodak Photo CD viewer is just that, a viewer. You can't author a new Photo CD with it. The bundle has no provisions for authoring Photo CDs or Enhanced CD (CD Plus) disks, or handling non-ISO or DOS file formats.

GLOSSARY

Common CD-R Terms Explained

Buffer underrun A common error where the data stream being fed from the CD-R's cache buffer falls behind the laser doing the writing.

Disk-at-once recording *Single-session recording* mode, where all the data to be included on a disk is written in one pass. You must write in this mode to have your CD mass-produced by a stamping house.

Incremental packet writing Like multisession Photo CD, this process lets you add data to a disk in multiple sessions and create a single table of contents when the disk is full. Unlike Photo CD disks, though, a disk written in this way is readable by other CD drives only when the disk is finalized, not before.

ISO 9660 The data-format and file-naming conventions that ensure CD-based data can be accessed across multiple computer platforms.

Multisession recording Creating a disk in several stages rather than all at once (see *single-session*).

On-the-fly recording Sending data from your hard disk directly to the CD-R burner, without creating a *physical image file* first.

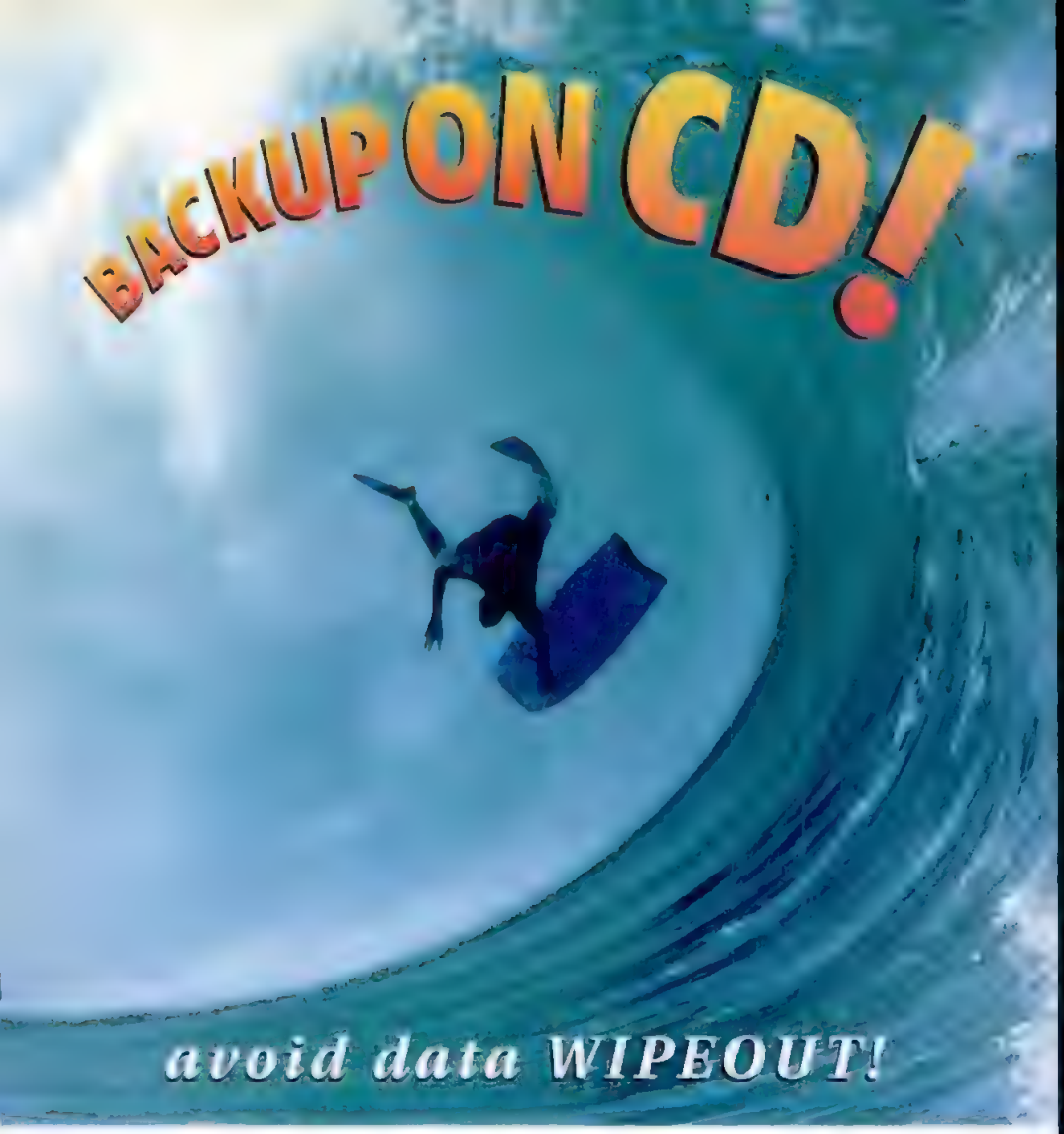
Physical-image file A complete, bit-for-bit mirror image of all the files to be burned to a CD-R disk in a recording session, stored on a hard disk.

Premastering/mastering software The software layer that readies files for recording. This involves converting file structures to adhere to the *ISO 9660* conventions, simulating the image on the hard disk as a CD-ROM, and sending the image to the CD-R drive.

Single-session recording The older CD-ROM standard, where all data you intend to put on a disk must be recorded in one session rather than in several different sessions over time.

Track-at-once recording A mode that lets you record contents to a disk in multiple sessions, a track at a time (see *disk-at-once recording*).

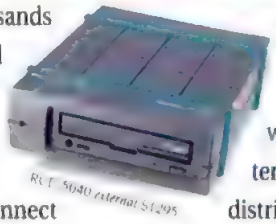
Virtual-image file A set of pointers to the files on your hard disk to be sent to the CD-R drive, rather than a duplicate *physical image* of those files. Usually employed for *on-the-fly recording*.



The #1 Selling Recordable CD System By Pinnacle Micro.

Replace your old tape backups with Pinnacle Micro's new RCD 5040. The industry's only Recordable CD system that works with Microsoft Backup. The RCD 5040 comes with everything you need to make your own CDs, including drive, controller card, software and media for only $995 complete.

Pinnacle's versatile Recordable CD system is like three drives in one. As a 4X CD-ROM player, you can play thousands of educational, multimedia, and audio CDs; as a 2X recorder, you can create custom audio, video, and data CDs up to 650 MB; and with the industry's only software connect to Microsoft Backup, the RCD 5040 offers fast, reliable archiving of compressed data - up to 1.3 GB** on a single CD. Each blank RCD disk costs only $15, or just 2¢ per megabyte.



The Recordable CD replaces tape with superior technology, such as random access to all your data (tape is slow); RCD media is playable in millions of CD-ROM drives (not tape); RCD media has a guaranteed shelf life of 100 years (tape has a life?). Just as CDs have replaced tape cassettes in the music industry, CDs are now well on their way to replacing tape in the computer industry.

So go ahead and backup on CD with Pinnacle Micro's RCD 5040 system. It's the best way to store, archive, distribute and create information. Best of all, it's now affordable. It's recordable. To order or for a local dealer call: **800.553.7070**

**Based on a 2:1 compression average.
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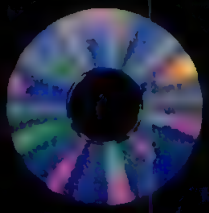
CIRCLE 270 ON READER SERVICE CARD

Backup on CD with Microsoft Backup only $995*

TAPE IS OUT.

Tape is slow
No random access
Five-year shelf life
Too many different formats
Reliable?

OPTICAL IS IN!



Recordable CD is fast
Random access
One hundred-year shelf life
CD-ROM standard format
Very reliable!

Microsoft Backup Utility

PINNACLE MICRO

Tel: 714-789-3000 Fax: 714-789-3150
http://www.pinnaclemicro.com

Performance Tests: CD-R Drives

Our testing showed that some of these products are not quite fully baked. Blame it on the software, though; we encountered few hardware-related problems.

If raw speed is what you require for operations potentially involving several thousand files, like data archiving or system backup, look equally to the mastering software's dexterity and ingenuity and to the write speed and mechanical capabilities of the CD-R drive mechanism. Perhaps even more important is the way the software and hardware coexist together.

The process of creating a CD from your PC is still something of a work in progress for many of the products we tested in this roundup. You can expect to devote significant time, if not to the installation and setup, then to the variety of software and hardware failures you might encounter when creating a CD. We were impressed with a few of the products we saw, like the JVC Personal Archiver and the Smart and Friendly CD-R 4000/Pro. They were the only products able to perform all of the tests in the rigorous PC Labs testing script.

HARDWARE FAILURES

A CD-R disk must be written to in a contiguous, track-by-track fashion, laying down (or "burning") data in a smooth uninterrupted stream. If a drive is unable to sustain an even and consistent data transfer rate from hard disk to CD-R while the laser is burning and the unit is momentarily left without anything to write, the buffer runs dry and a *buffer underrun* occurs. The CD you are trying to write to must be thrown away, and you'll have to start over. While we experienced several buffer underruns, they were usually caused by a setup conflict, because the systems we used in our test-bed were quite fast (see the description of our test-bed systems under "How We Tested" on the next page) and able to sustain the throughput rates required to keep the CD-R buffer continuously fed.

SOFTWARE FAILURES

Several of the failures experienced during testing occurred during the *premastering* of the disk. At this stage, the files are selected and made ready for recording to the CD. This stage usually includes creating pointers to file locations, or writing a binary image file of the data to the hard disk. Errors we encountered included GPFs and system freezes. It should be pointed out that while some products impressed us with a lack of problems in each of the areas we tested, the amount of time wasted by failures of any kind might obstruct this technology's entrance into the mainstream.

What the Numbers Mean

On our On-the-Fly Recording test, the MicroNet MasterCD Pro and the Smart and Friendly CD-R 4000/Pro turned in the best times, averaging approximately 15 minutes to process 280MB of data split across 17,642 files, most of which were less than 1K in size. Both devices used the Yamaha drive mechanism and came bundled with Incat's premastering software Easy-CD Pro.

Easy-CD Pro employs a cyclical buffering scheme, where data, after being formatted for the CD-R, is passed to a buffer on the hard disk that is the same size as the buffer on the CD-R. As the buffer on the CD-R empties, the data waiting on the hard disk is passed to the drive mechanism for writing. This double buffering, or two-man assembly-line processing with one sending data in and one sending data out, proved extremely effective and appeared to lessen the chance of a buffer underrun.

The same Yamaha mechanism found in the MicroNet and Smart and Friendly bundles, however, turned in times nearing 30 minutes for the On-the-Fly Recording test when paired with Corel CD Creator 1.02 (note the performance of the Procom PCDR-4X and the Yamaha CDR100). This was due to the way CD Creator processes its files in the version of the software available at test time. Since we were unable to set the working "scratch pad" directory in CD Creator to our third partition (where we set aside 1GB of free space for temporary file I/O and buffering operations), Corel CD Creator was limited to the space it would allow us to designate in its Preferences dialog box.

Because of this, Corel's software prepared only about 11,000 files before it ran out of scratch space on the C: drive, at which point it closed the track and began processing the rest of the files. As the rest of the files were prepared, the session resumed in a new track. This smart approach to buying time while in the middle of a file I/O task probably saved us from what would have been a buffer underrun, but also contributed to the slower performance. While the resulting disk was suitable for typical business backup and archiving, such multitrack data can be read only on a CD-ROM XA–compatible CD

ON-THE-FLY RECORDING

Hours:minutes:seconds ▶ 0:00:00 0:30:00 1:00:00 1:30:00 2:00:00 2:30:00

2X drives		
HP SureStore CD-Writer 4020i		0:27:58
JVC Personal Archiver		0:22:44
JVC CD-R Direct		0:38:28
Microboards PlayWrite 2000	☒	
MDI Express Writer	☒	
Olympus Deltis CD-R2	☒	
Optima DisKovery 650 CD-R		0:21.40
Philips CDD2000/20		0:25:34
Pinnacle Micro RCD 5020		1:44:51
Plasmon CDR4220		2:12:15
Ricoh RS-1060C		0:22:06
Smart and Friendly CD-R 1002/Pro		0:22:53
Sony Spressa		0:34:19
4X drives		
DynaTek CDM 400	☒	
MicroNet MasterCD Pro		0:13:59
Pioneer DW-S114X	☒	
Procom PCDR-4X		0:27:52
Smart and Friendly CD-R 4000/Pro		0:16 53
Yamaha CDR100		0:28:50

☒—FAIL: The product did not complete this test. BEST WORST

Format Torture Tests

■ PASS
☒ FAIL

	Create Enhanced CD (CD Plus)	Create Multisession CD (Photo CD)	Create and Copy Red Book Audio	Copy Commercial CD-ROM
DynaTek CDM400	☒	N/A	■	■
HP SureStore CD-Writer 4020i	N/A	☒	■	■
JVC Personal Archiver	■	■	■	■
JVC CD-R Direct	☒	☒	☒	■
Microboards PlayWrite 2000	☒	☒	■	■
MDI Express Writer	N/A	N/A	N/A	N/A
MicroNet MasterCD Pro	■	☒	■	■
Olympus Deltis CD-R2	N/A	☒	■	■
Optima DisKovery 650 CD-R	☒	N/A	■	■
Philips CDD2000/20	☒	☒	■	■
Pinnacle Micro RCD 5020	N/A	■	■	■
Pioneer DW-S114X	☒	N/A	■	■
Plasmon CDR4220	N/A	■	■	■
Procom PCDR-4X	☒	N/A	■	■
Ricoh RS-1060C	N/A	N/A	■	■
Smart and Friendly CD-R 1002/Pro	☒	■	■	■
Smart and Friendly CD-R 4000/Pro	■	■	■	■
Sony Spressa	☒	■	■	■
Yamaha CDR100	☒	N/A	■	■

N/A—Not applicable: The product was not designed to handle this task.

drive, a format not supported by many older single-speed drives. Such a disk also could not be used as an original for a disk-duplicating house.

Products bundling Elektroson's GEAR MM had an even rougher time and failed to complete the On-the-Fly Recording test. The GEAR software formatted each file for the CD-ROM sector on the fly and directly transferred it to the CD-R drive's buffer after completing the process. Since it does not use a buffering scheme on the hard disk to store already processed data, its method appeared to choke on the succession of small files presented to it. On other tests involving smaller numbers of files, neither CD Creator 1.02 nor GEAR MM 3.23 exhibited any problems. Both Corel and Elektroson claim that imminent versions of the software will address these problems.

DRIVE SPEED

The majority of the mechanisms in the products we tested wrote at 2X speed. The 2X JVC Personal Archiver, Ricoh, and Smart and Friendly drives essentially tied one another on our timed test (their times were less than a minute apart). The Pinnacle Micro RCD 5020, which uses Corel CD Creator, would work only with 32-bit file access and 32-bit disk access under Windows for Workgroups turned off. Also, we had to drop the transfer rate on the SCSI bus from 10 MBps to 5 MBps, and turn synchronous transfer mode off (all at the request of the vendor) in order to get the drive to work. This accounts for its slow performance. The Plasmon CDR4220 encountered many problems throughout the testing process, and the 2-hour-plus time it took on this test was the best we were able to obtain from it.

In our Format Torture Tests chart we list pass/fail scores for four tasks: Create Enhanced CD (CD Plus), Create Multisession CD (Photo CD), Create and Copy Red Book Audio, and Copy Commercial CD-ROM. In order to pass these tests, each CD we created was required to pass a verification process on assorted CD-ROM drives at PC Labs, ranging from a single-session drive (for Yellow Book Mode 1 CDs) to multisession 4X and 6X drives. Verification involved opening and viewing files off the newly created CD on each appropriate CD reader. If a vendor did not claim support for one of the four tests, "N/A" (for *not applicable*) appears as the result.

How We Tested

We tested these products on 133-MHz Micron Millennia Pentiums configured with16MB EDO RAM and 256K L2 cache. Each system was equipped with an ATI Mach64 graphics card with 2MB of VRAM running at a resolution of 800-by-600 in 24-bit color, an Adaptec AHA-2940 PCI SCSI controller card using EZ-SCSI 4.0 software and drivers, a Creative Labs Sound Blaster AWE32-CT3780 sound card, a Proteon 1392plus Token-Ring network interface card, a 2.1 GB Conner CFP 2107S SCSI hard disk, a Plextor PX-63CS 6Plex CD-ROM drive, and the 17-inch MAG Innovision MXP17F monitor. We defaulted to Windows for Workgroups 3.11 as our operating system, set up with a 40,960K permanent swapfile with 32-bit disk access enabled, 32-bit file access enabled, and 4,096K of v-cache. We sometimes upgraded to Windows 95 at the vendor's request, or if the bundled software required it. If the vendor shipped its own SCSI adapter board, we used it either at the vendor's request or when we experienced problems daisy-chaining the unit off of the Adaptec.

PC Labs' test script called for burning several blank CDs in a variety of formats. To evaluate each product's ability to archive data, we designed a multiple directory structure for the **On-the-Fly Recording** test that included 17,642 ISO 9660–compliant files of various sizes, with the majority less than 1K. Another directory contained ISO rules violations, such as a directory structure greater than eight subdirectories deep, and filenames including characters other than A–Z and 0–9. We tested the way the software handled rules violations and whether it could issue alerts or convert these instances.

Our Enhanced CD test examined whether each product could write to that format. Also known as CD Plus, the Enhanced CD format (which is in final draft but beginning to be used by the music industry) requires that the first session of the CD be in CD/DA (digital audio) format and the second session be in CD-ROM/XA format. In addition to looking at the data, the verification process included playing the audio session on a Sony Discman, and trying the disk under Windows 95, which has direct support for CD-Plus.

Our multisession Photo CD test determined whether each product could create a disk in that format. We also tested Red Book audio support and the product's ability to copy a commercial CD-ROM.—*Analysis written by Jeff Mace.*

The test files for the archive task were supplied by Walnut Creek CD-ROM, of Concord, California, a CD-ROM publisher. Dr. Ash Pawah of CD-ROM Strategies, author of The CD-Recordable Bible, *provided testing insights as well as the audio files we used for the tests.*

The 4020i is a bargain for users who want a CD-R backup solution, and is limited more by its software than the hardware design. If you want more features, the money you save can be applied towards more robust authoring tools.—*James Karney*

HP SureStore CD-Writer 4020i. List price: $1,249. Hewlett-Packard Co., Loveland, CO; 800-810-0134, 970-635-1575; fax, 970-667-0997. http://www.hp.com/go/storage_support. *Circle 445 on reader service card.*

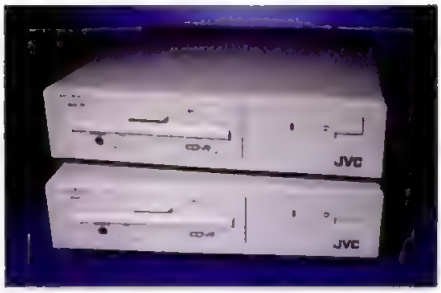
JVC Information Products Co. of America

JVC Personal Archiver; JVC CD-R Direct

The JVC Personal Archiver ($1,195 list, $995 street) isn't flashy or fancy, but it was one of the more versatile and reliable packages in this roundup. Granted, the Personal Archiver software has a clunky interface that shows its DOS-based roots, and the 2X-read/2X-write JVC XRS-201 drive mechanism seems fairly pedestrian in an age of 4X drives, but the combination proves the old adage that slow and steady wins the race. The company's other offering in this roundup, the CD-recording system JVC CD-R Direct ($1,195 list, $1,000 street), pairs a clever backup utility with the same XRS-201 drive, but this system pales in comparison with more robust bundles in its price range.

Both packages include an Adaptec AHA-1510A SCSI controller, cable, and terminator, along with EZ-SCSI software (Version 3.1), a CD caddy, and two blank disks. The Windows-based setup procedures were simple and straightforward; installation of CD-R Direct and Personal Archiver proceeded without incident. Personal Archiver requires an A/V-rated SCSI hard disk, but CD-R Direct can use an IDE drive to write its temporary files.

The Personal Archiver software was able to negotiate nearly every task that we threw at it, but it does have its share of quirks. For example, each partition on your SCSI hard disk must be labeled using DOS's LABEL command or Archiver won't be able to see it. It performed fairly



SUITABILITY TO TASK

	Personal Archiver		CD-R Direct	
	Power	Ease	Power	Ease
Initial startup	Good	Good	Fair	Excellent
Backup	Good	Good	Good	Excellent
Disk duplication	Good	Good	Good	Good
Format flexibility	Good	Fair	Fair	Fair

well for a 2X drive on the On-the-Fly Recording test (22 minutes 44 seconds). We were unable to create a bit-for-bit image copy of a commercial CD. But we were able to create several advanced CD types that other drives couldn't: multisession Photo CD, Enhanced CD (CD Plus), and CD-audio disks from .WAV files and prerecorded CDs. One minor complaint: The software is somewhat obtuse and it hides physical formatting issues from the user. To make a CD Plus disk, for example, you select "Track at Once," write the audio portion as a "Single Session," then append a data session (choose "Multi Session, Aggregate"). You can not specify that the data track on the CD Plus disk that you are creating needs to conform to the CD-ROM XA Mode 2, Form 1 format, nor can you simply choose CD Plus from a list of CD types.

The less flexible CD-R Direct lets you treat a blank CD-R disk like a write-once floppy disk. The software lets you assign a drive letter to the CD recorder, after which you format the disk and simply copy files to it using Windows' File Manager or DOS copy commands. Once you finalize the disk, it can be read on any CD-ROM reader, but disks-in-progress are accessible only via the device driver. We were able to create on-the-fly backups with the CD-R Direct, but the unit was excruciatingly slow: When paired with the CD-R Direct software, the JVC XRS-201 completed our On-the-Fly Recording test in just under 40 minutes—almost twice as long as the same mechanism took using the Personal Archiver software.

Compared with other bundles in the review, the CD-R Direct package falls a bit short. The JVC Personal Archiver CD-Recording System was among the more reliable systems we saw, performing as advertised on test after test and offering support for a wide range of CD formats. The premastering software is a bit kludgy, but the reliability makes the drive a good business workhorse.—*JH*

JVC Personal Archiver. List price: Internal version, $1,195; external version, $1,295. **JVC CD-R Direct.** List price: Internal version, $1,195; external version, $1,295. JVC Information Products Co. of America, Irvine, CA; 714-261-1291; fax, 714-261-9690. *Circle 446 on reader service card.*

Microboards of America Inc.

PlayWrite 2000

Like other products in this roundup that come bundled with Elektroson's premastering software GEAR MM for Windows 95, Microboards' PlayWrite 2000 package ($1,295 list) was hobbled by some of our demanding tests. The 2X-read/2X-write Sony drive mechanism combined with the GEAR application may prove a fine choice for light-duty CD creation, but intensive on-the-fly recording tended to break the otherwise versatile software.

It took less than 5 minutes to connect the drive and load the software. Versions for several operating systems are bundled, including Windows 3.1, Windows 95, Windows NT, and OS/2 Warp (we tested under Windows 95).

The GEAR software does have its strong points. You can drag and drop files from the File Manager window to the

SUITABILITY TO TASK

	Power	Ease
Initial startup	Good	Excellent
Backup	Fair	Good
Disk duplication	Good	Fair
Format flexibility	Fair	Fair

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GEAR window to create a virtual image. From there you have the option to write the files on the fly or create a physical image of the CD onto the hard disk. However, on our demanding On-the-Fly Recording test (which contained over 17,000 files), the package choked. The test files included thousands of small files under 1K; the delay in processing these small files caused the PlayWrite's buffer to run dry and prematurely end recording. Elektroson said it plans to optimize GEAR's delivery of files to the buffer in the next version.

To get around the limitation in the meantime, you can create a physical image of the files to your hard disk (provided you have the space to spare). This process took more than an hour for our test data, but the drive burned the CD in less than 20 minutes.

Like all the drives in this roundup, the PlayWrite supports track-at-once (TAO) recording. For those who are looking to premaster an aluminum CD for volume reproduction, or who want tighter control over the space between audio tracks, the package also supports disk-at-once (DAO) recording. GEAR also supports Audio Interchange File Format (AIFF), .WAV, and raw audio files in PCM (pulse code modulation) format. In short, we had no problem creating a Red Book audio CD with multiple tracks.

The bundle was supposed to write multiple sessions in ISO format, but we consistently ran into problems writing multisession in CD-ROM XA and Photo CD formats. Elektroson's responsive technical support was not able to recreate or solve the problem. The package also did not support Enhanced CD (CD Plus), though it should by the time you read this.

Overall, if you are looking to burn professional audio or multimedia game titles, the PlayWrite is a good deal. For on-the-fly tasks such as archiving and backup, you are better off elsewhere.—*Denis Tom*

PlayWrite 2000. List price: $1,295. Microboards of America Inc., Chanhassen, MN; 800-646-8881, 612-470-1848; fax, 612-470-1805. *Circle 447 on reader service card.*

Micro Design International Inc.

Express Writer

Micro Design International (MDI) targets its Express Writer package for archiving and backup in heavy-duty word processing environments such as law offices. The target market explains the lack of software support for anything but Yellow Book Mode 1 format. However, the relatively steep $2,195 list price ($1,800 street) makes it hard to justify those limitations, or the slow performance.

As tested, the Express Writer hardware is built around a Pinnacle drive, which according to MDI is manufactured by JVC. The drive can read and write at both 1X and 2X speeds. Be aware, however, that MDI plans to replace this drive mechanism within one or two months after this review is published. At this writing, MDI is evaluating two drives that offer 2X write speed with a 4X read speed. The company also plans to drop the price to about $1,200, which would make this a much more competitive package.

SUITABILITY TO TASK

	Power	Ease
Initial startup	Fair	Fair
Backup	Fair	Fair
Disk duplication	Poor	Poor
Format flexibility	Poor	Fair

Along with the drive, the package includes only the power cord and software, although you can order it with a hard disk, SCSI card, and cable as well. If you have a SCSI card already installed and a cable on hand, setup consists of plugging in the power cord and cable, then installing the software.

MDI supplies its own software, your choice of either Express Writer 1.0 for Windows or Express Writer for OS/2 (we tested it with the Windows version). The program is easy enough to use, but limited. According to MDI, the *drive* supports Yellow Book Mode 1 and Mode 2 formats as well as Red Book audio. However, the *software* supports only Yellow Book Mode 1, which means that, among other limitations, you can't record audio. Also missing from the software is any easy way to copy a commercial CD.

These limitations mean the drive was suitable for only three of our tests. Unfortunately, it didn't perform well even on those. On the two tests that created an image file on-disk and then created the CD from the image file, the package took over 1 hour 49 minutes to index the files, and nearly 1 hour 48 minutes to create the image file. MDI says this is because we had 10,000 files in one directory, and the time would be less with the same files scattered over multiple directories. Creating the CD itself took just 19 minutes 2 seconds, which is typical for a 2X recorder.

On the third test, creating a CD on the fly, the package not only took just as long to index the files but failed to create the CD, with an error message that indicated a hardware failure. A replacement drive gave the same result, which suggests that the problem lies elsewhere. MDI was not able to reproduce the problem using its own set of test data.

All told, the Express Writer package has too many strikes against it. Even if the drive had managed to finish the third test, the time it takes to index the files would make it the slowest package by far. Factor in the price and the limited formats supported and it's just too easy to find a drive that does more, works faster, and costs less.—*M. David Stone*

Express Writer. List price: $2,195. Micro Design International Inc., Winter Park, FL 32792; 800-228-0891, 407-677-8333; fax, 407-677-8365; http://www.microdes.com. *Circle 449 on reader service card.*

MicroNet Technology Inc.

MasterCD Pro

You don't have to look further than the price—$2,895 list and typically $2,695 on the street—to know that MasterCD Pro, from MicroNet Technology, is aimed at heavy-duty professional users. MicroNet says its target market includes game developers, people who make multimedia presentations, and service bureaus in the prepress and publishing industry. The package, with its 4X

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CIRCLE 218 ON READER SERVICE CARD

SUMMARY OF FEATURES

CD-R Drives

■ YES ○ NO

In alphabetical order by company

	DynaTek Automation Systems Inc. **DynaTek CDM400**	Hewlett-Packard Co. **HP SureStore CD-Writer 4020i**	JVC Information Products Co. of America **JVC CD-R Direct, JVC Personal Archiver**	Microboards of America Inc. **PlayWrite 2000**	Micro Design International Inc. **MDI Express Writer**	MicroNet Technology Inc. **MasterCD Pro**	Olympus Image Systems Inc. **Deltis CD-R2**	Optima Technology Corp. **DisKovery 650 CD-R**
Price	$2,499 (list)	$1,249 (list)	Internal, $1,195 (list); external, $1,295 (list)	$1,295 (list)	$2,195 (list)	$2,895 (list)	$1,289 (list)	$1,650 (list)
Mechanical Specifics								
Mechanism manufacturer	Yamaha	Philips	JVC	Sony	JVC	Yamaha	Olympus	Sony
CD-ROM read speed	4X	4X	2X	2X	2X	4X	2X	2X
Average seek time	500 ms	400 ms	350 ms	300 ms	300 ms	300 ms	250 ms	200 ms
Sustained throughput rate	614 KBps	600 KBps	300 KBps	300 KBps	300 KBps	600 KBps	300 KBps	300 KBps
Buffer size	512K	1MB	1MB	1.2MB	1MB	512K	1MB	1MB
CD-R write speed (maximum)	4X	2X	2X	2X	2X	4X	2X	2X
Average seek time	500 ms	300 ms	350 ms	300 ms	300 ms	300 ms	250 ms	300 ms
Sustained throughput rate	614 KBps	300 KBps	300 KBps	300 KBps	300 KBps	600 KBps	350 KBps	300 KBps
Buffer size	512K	1MB	1MB	1.2MB	1MB	512K	1MB	1MB
Supports SCSI/SCSI-2 interface	■ ■	○ ■	■ ■	■ ■	○ ■	■ ■	○ ■	○ ■
Supports proprietary SCSI interface	○	○	○	○	○	○	○	○
Make and model of included interface card	N/A	Advansys APP 510	Adaptec AHA 1510	Adaptec AHA-1535	N/A	N/A	Future Domain TMC 1610 MER	N/A
Media and Software								
Drive certification:								
2X media	■	■	■	■	■	■	■	■
4X media	■	○	■	■	○	■	■	■
6X media	○	○	■	■	○	■	■	■
Brand of media recommended	Sony	HP SureStore	TDK/JVC	Taiyo Yuden, TDK	MDI Media	MicroNet Media	N/A	Optima
Number of blank disks included	1	2	2	2	10	1	1	5
Premastering software included	DiscMaster	Easy-CD for HP	JVC Personal Archiver	GEAR MM for Windows 95	Express Writer	Easy-CD Pro for Windows 3.1, Windows 95, and Windows NT	GEAR MM	Easy-CD Pro for Windows 3.1, Windows 95, and Windows NT
Other applets included	None	Alchemy Personal for HP, Easy-CD Audio, Magic Lantern	JVC CD-R Direct Backup, JVC CD-R Direct Extensions	Creative Digital Research	SCSI Express for OS/2 or DOS/Windows	Easy-CD BackUp	None	Wave Editor
Software analyzes PC configuration	■	■	■	■	■	■	○	■
Functions supported by premastering package(s):								
On-the-fly recording	■	○	■	■	■	■	■	■
Disk-at-once/Track-at-once	■	■	■ ■	■ ■	○ ■	■ ■	■ ■	■ ■
Incremental packet writing	○	○	■	○	○	○	■	■
Preview before committing to disk	○	○	■	■	■	■	○	■
Formats supported by premastering package(s)								
Yellow Book/Red Book Audio	■ ■	■ ■	■ ■	■ ■	■ ○	■ ■	■ ■	■ ■
CD-ROM XA (Mode 2, Form 1)	■	○	○	■	○	■	■	■
CD-ROM XA (Mode 2, Form 2)	■	○	○	■	○	■	■	■
MultiSession (Orange Book)	■	■	■	■	■	■	■	■
CD-I/VideoCD (White Book)	○	○	○	■	○	■	■	■
Enhanced CD (CD-Plus)/Photo CD	■ ○	○ ■	■ ■	■ ■	○ ○	■ ■	○ ■	■ ○
Details								
Disk design	Caddy	Tray	Caddy	Caddy	Caddy	Caddy	Caddy	Caddy
Dimensions (HWD, in inches)	2.5 x 8.3 x 10.4	1.6 x 5.8 x 8.1	2.8 x 10.6 x 11.8	2.0 x 9.5 x 9.5	2.4 x 8. x 10.2	5.0 x 7.5 x 12.0	4.7 x 6.8 x 10.8	2.5 x 11.4 x 10.2
Weight (in pounds)	6 0	2.2	8.8	5 3	2.6	12.0	8 0	8 0
Toll-free tech support included	■	○	■	■	■	○	■	■
Technical-support hours (eastern time)	8:00–5:00, M–F	10:00–7:00, M–F	12:00–8:00, M–F	24 hours, 7 days	8:00–8:00, M–F	7 days, 24 hours	9 00–5:00, M–F	10:30–8.30, M–F
E-mail or Web address	*info@raider.dynatek.ca*	*http://www.hp.com/go/storage_support/cdr*	None	None	*sales@microdes.com*	*info@micronet.com*	None	*http://www.optimatch.com/optima/*

N/A—Not applicable: The product does not have this feature.

	Philips Electronics North America Corp. **Philips CDD2000/20**	Pinnacle Micro Inc. **Pinnacle Micro RCD 5020**	Pioneer New Media Technologies Inc. **Pioneer DW-S114X**	Plasmon Data Inc. **Plasmon CDR4220**	Procom Technology Inc. **Procom PCDR-4X**	Ricoh Corp. **Ricoh RS-1060C**	PC MAGAZINE EDITORS' CHOICE Smart and Friendly **Smart and Friendly CD-R 1002/Pro**	PC MAGAZINE EDITORS' CHOICE Smart and Friendly **Smart and Friendly CD-R 4000/Pro**	Sony Electronics Inc. **Sony Spressa**	Yamaha Systems Technology Inc. **Yamaha CDR100**
	$1,295 (list)	Internal, $995 (list); external, $1,295 (list)	$3,495 (list)	$1,299 (list)	$1,699 (list)	$995 (list)	$1,099 (street)	$2,399 (street)	$1,495 (list)	$1,495 (list)
	Philips	Pinnacle	Pioneer	Philips	Yamaha	Ricoh	Smart and Friendly	Yamaha	Sony	Yamaha
	4X	2X	4X	4X	4X	2X	2X	4X	2X	4X
	300 ms	300 ms	600 ms	350 ms	500 ms	380 ms	300 ms	500 ms	300 ms	500 ms
	600 KBps	307 KBps	614 KBps	705 KBps	1,500 KBps	352 KBps	300 KBps	614 KBps	300 KBps	600 KBps
	1MB	1MB	1MB	1MB	512K	512K	1MB	512K	1MB	512K
	2X	2X	4X	2X	4X	2X	2X	4X	2X	4X
	390 ms	300 ms	600 ms	350 ms	500 ms	380 ms	300 ms	500 ms	300 ms	500 ms
	300 KBps	307 KBps	614 KBps	353 KBps	1,500 KBps	352 KBps	300 KBps	614 KBps	300 KBps	600 KBps
	1MB	1MB	1MB	1MB	512K	512K	1MB	512K	1MB	512K
	■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■		■
		■	■	■	■	■	■	■	■	
	Adaptec AHA-1540	Adaptec AHA-1520	N/A	Adaptec Total CD AVA-1505	N/A	N/A	Adaptec 1502	Adaptec 1502	N/A	N/A
	■	■	■	■	■	■	■	■	■	■
	■	■	■	■	■	■	■	■	■	■
	■	■	■	N/A	■	■	■	■	■	■
	N/A	DOT, Kodak	Pioneer Media	Plasmon	Mitsui, TDK	Ricoh	N/A	N/A	Sony	TDK, Yamaha
	1	2	10	1	1	6	1	1	8.	None
	WinOnCD ToGo! for Windows 3 1	Corel CD Creator for Windows 3 11	Easy-CD Pro for Windows 95	Easy-CD Pro for Windows 3.1, Windows 95, Windows NT, and Macintosh	Corel CD Creator	CD-Print for Windows and Macintosh	Easy-CD Pro for Windows 3.1, Windows 95, Windows NT, and Macintosh	Easy-CD Pro for Windows 3.1, Windows 95, Windows NT, and Macintosh	Corel CD Creator for Windows 3.1	None (tested with Corel CD Creator for Windows 3.1)
	None	Corel's Best	None	None	None	None	CD Workshop, Easy-CD BackUp	CD Workshop, Easy-CD BackUp	None	None
	■	■	■	■	■	■	■	■	■	N/A
	■	■	■	■	■	■	■	■	■	N/A
	■	■	■	■	■	■	■	■		N/A
	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	N/A
	■			■			■	■	■	N/A
				■			■	■	■	N/A
	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	N/A
	■	■	■	■	■		■	■	■	N/A
	■		■	■			■	■	■	N/A
	■	■	■	■	■	■	■	■	■	N/A
	■		■	■			■	■	■	N/A
	■ ■	■ ■	■	■ ■	■ ■		■ ■	■ ■		N/A
	Tray	Caddy	Tray	Tray	Caddy	Caddy	Caddy	Caddy	Caddy	Caddy
	1 6 x 5.8 x 8.2	1.7 x 5.8 x 8.2	4.5 x 8.0 x 15.7	2.5 x 9.0 x 12.7	2.4 x 9 6 x 10.5	2.1 x 9.8 x 10.5	2.3 x 9.8 x 10.5	2.5 x 9.8 x 10.5	2.8 x 8.3 x 11.5	1 6 x 5 8 x 8.0
	2 5	2 2	11.1	8.0	4.3	1.8	8.0	8 0	9 2	3 3
	■		■	■	■	■			■	■
	8 00–4 00, M–F	9:30–8:30, M–F	10:00–7:00, M–F	11:00–9 00, M–F	11:00–7:00, M–F	9 00–5 00, M–F	10:00–8:30, M–F	10 00–8:30, M–F	11:00–8 00, M–F	11.00–8 00, M–F
	http://www .philips.com	*http://www .pinnacle.micro .com*	None	*marketing@ plasmonca .com*	*info@procom .com*	*74774.3141@ compuserve .com*	*http://www .smartand friendly.com*	*http://www .smartand friendly com*	*http://www .sel.sony.com/ SEL/ccpg*	None

maximum write speed, is well targeted to these audiences.

The hardware side of the package is built around a Yamaha drive mechanism and can record at 1X, 2X, or 4X and read at 4X. Six status lights make it easy to tell what the drive is doing at any time.

Installation is typical for an external SCSI drive. If you already have a SCSI adapter, you simply plug in the supplied power cord and cable (you can order the cable with the connectors you need) and then install the software. You can also order the drive with an ISA, EISA, or PCI SCSI card.

The software side of this package consists of Incat's Easy-CD Pro MM 3.0 for Windows 3.1, Easy-CD Pro MM 1.0 for Windows 95 and Windows NT, and Easy-CD BackUp 1.3. The first two are full-blown mastering programs—not the "lite" versions typically included in less expensive bundles. Easy-CD BackUp follows a tape-backup metaphor to let you easily use the recorder as your backup device. We used Easy-CD Pro MM for Windows 3.1 in our tests, since MicroNet said it would give better performance than the Windows 95 version.

Once you figure out how to use Easy-CD Pro, it's both straightforward and capable. The program supports Yellow Book Mode 1 and 2; CD-ROM XA Mode 2, Form 1 and Mode 2, Form 2; Red Book audio: and Orange Book multisession. There's no specific Enhanced CD (CD Plus) support, but you can create a disk with audio in the first session and data in the second, and play the audio on a CD player as well as see the data in Windows 95.

SUITABILITY TO TASK

	Power	Ease
Initial startup	Fair	Fair
Backup	Excellent	Fair
Disk duplication	Excellent	Good
Format flexibility	Good	Fair

On our tests, the package breezed through everything except for Photo CD format, which it doesn't support, and creating a Mac-PC hybrid, which, according to MicroNet, requires a Mac-formatted hard disk plugged into the SCSI chain.

Performance was a strong point, thanks in large part to the 4X write speed. The package took 1 minute 45 seconds to index roughly 18,000 files, 9 minutes 15 seconds to create an image on-disk, and 10 minutes 17 seconds to burn the CD. Creating a CD on the fly took a mere 14 minutes—the best time we saw.

The combination of fast performance, robustness, and range of supported formats makes this package well suited to its intended market. The software's ease of use is an additional bonus. If you need to create CDs on a regular basis and want to create them quickly, Master CD Pro is worth every penny.—*MDS*

MasterCD Pro. List price: $2,895. MicroNet Technology Inc., Irvine, CA; 714-453-6100; fax, 714-453-6101; http://www.micronet.com. *Circle 448 on reader service card.*

Olympus Image Systems Inc.

Deltis CD-R2

There is something to be said for simplicity. The virtually hassle-free Deltis CD-R2, with a list price of $1,289, provides even novice users with a quick and easy way to create their own CD-ROM disks. One of the cheaper options in this roundup, the Deltis comes bundled with GEAR MM 3.2 software from Elektroson and is being marketed towards those in need of a write-once, high-capacity optical storage device in such industries as medical imaging, legal offices, and customized audio/video. Be warned, however, that while the GEAR MM software is intuitive and versatile (especially for audio applications), on-the-fly recording of large numbers of files is its Achilles' heel.

The Olympus unit offers basic 2X-read/2X-write functionality and few frills: Just a volume control, headphone jack, and flickering indicator light adorn the front panel. The caddy design features an auto-load/auto-eject feature. Setup is as easy as plugging in the supplied Future Domain SCSI-2 adapter to your PC and then connecting directly to the sturdy Olympus external subsystem.

Equipped with a generous 1MB data buffer memory, the Deltis lives up to its title of 2X, cranking out an hour's worth of audio files in 30 minutes almost to the second. The GEAR software made copying Red Book audio tracks from a normal audio CDs as easy as dragging and dropping files out of File Manager. Logical icons, such as a little compact disk engulfed in flames, make burning disks a snap. Also, when you click on the "CD info" icon, all tracks are archived in sequence for each individual session, in case you lose your place during a burn.

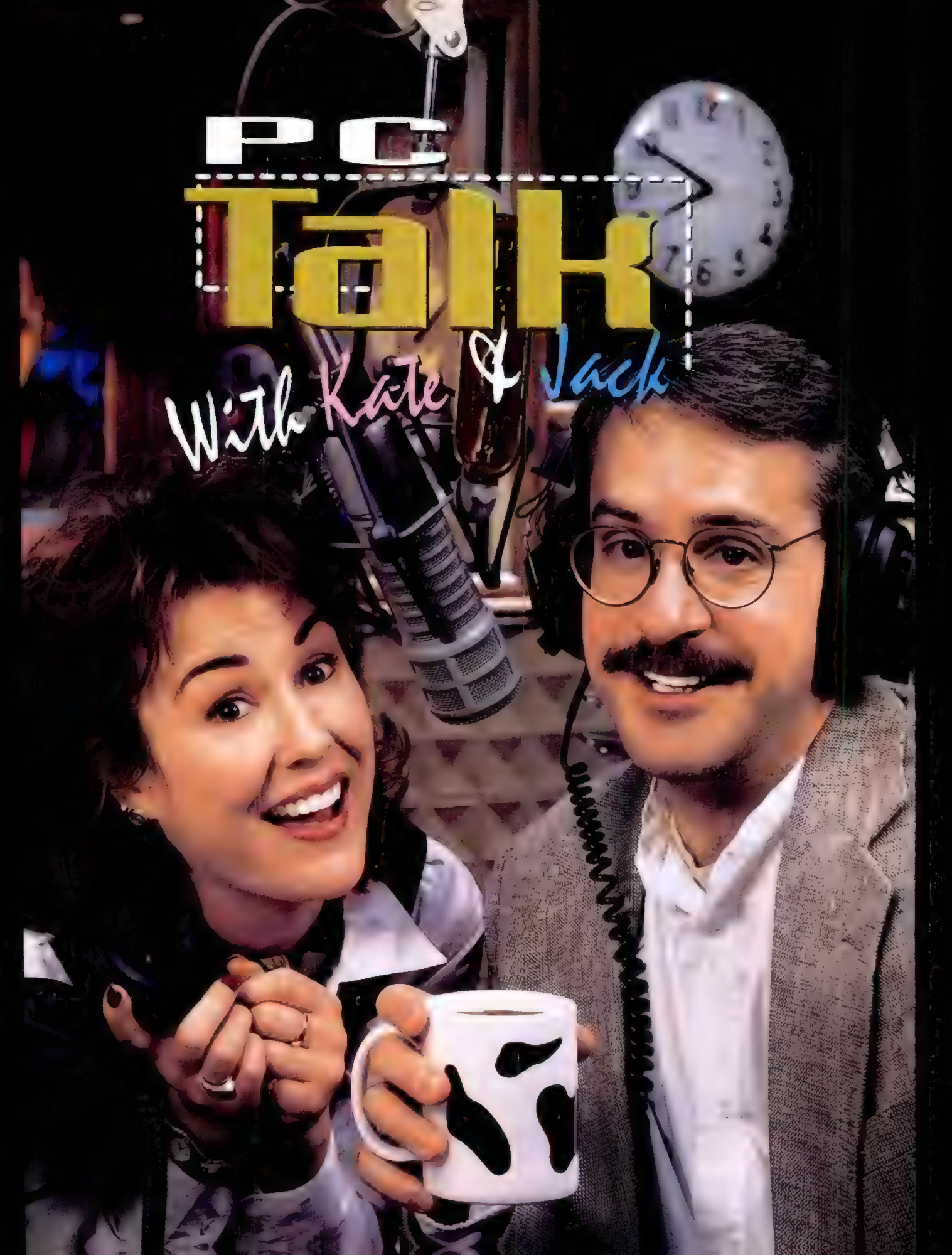
SUITABILITY TO TASK

	Power	Ease
Initial startup	Good	Good
Backup	Fair	Fair
Disk duplication	Good	Good
Format flexibility	Fair	Fair

On some of our more demanding tasks, though, the software choked under pressure. Although tech support and the literature both claim that the unit can produce Enhanced CD (CD Plus) and Photo CD disks, the Deltis failed our lab tests in these areas. Also, as with other GEAR MM–equipped systems, writing our database of more than 17,000 files in the On-the-Fly Recording test consistently caused buffer underruns. Elektroson has acknowledged the problem and promised a fix in the next version.

The GEAR software does allow you to verify a disk before actually writing it, which many of the other packages fail to do. The manual is fairly self-explanatory and a breeze to follow—although there are no explanations for certain failures, as in the case of the multisession error message.

With the problems we had on our tests, it's hard to recommend the Deltis CD-R2 with GEAR wholeheartedly. Many users will never experience the problems we did,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Kate: Rise and shine sleepy heads! It's time to drag your sorry tails out of the sack and boot up your PCs. You're locked into PCQA's *"PC Talk with Kate and Jack."* Your *only* source for the latest computer industry news.

That's right! We're ready to dive headfirst into some heavy-duty PC talk. But first I want to let all you computer gurus out there in on our little secret.

Kate: *Jack!* You blabbermouth — I thought we were going to keep a lid on it until the news! Bob, you're the controller. Keep your ears peeled for loose lips today!

Bob: Sure thing, Kate!

Sorry Kate — you know I can't keep a secret. Here's the scoop — we're fired up this morning because we're starting a new product review segment. We'll kick it off at approximately 10 a.m. when Chuck the delivery guy arrives with the black-and-white cow-spotted boxes.

Kate: OK, the cat's out of the bag! We're ready to talk speed! Meg from Maine, you're on!

Meg: ***Hey, Gateway 2000 created a real screamer when they took the fastest Pentium® processor on the market — the Intel 166MHz Pentium processor — and put it in their P5-166 Professional system.***

The P5-166 Professional system features 16MB EDO DRAM, 256K pipelined burst cache, 2GB hard drive, 6X CD-ROM drive and Microsoft® Office 95, Professional Edition for only $2,899.

You've got that right. Gateway has a reputation for ultra-speedy PCs. In fact, the February 1996 *Windows Sources* cover tagged a Gateway 2000 166MHz Pentium processor-based system as "the fastest Win 95 PC ever."

Meg: *I believe it! We have a whole fleet of Gateway P5-166 Professional systems at my accounting firm. Our clientele has doubled in less than two months because we're cranking through spreadsheets and crunching numbers like crazy. In a nutshell, productivity has skyrocketed, and that means my business is more profitable.*

intel inside pentium PROCESSOR

Where'd you get these mean machines, Meg?

Meg: *Gateway 2000. Only $2,899 a crack.*

How can Gateway offer such a powerful system at that low price?

Meg: *It's simple, Jack.* ***Gateway knows how to cost effectively configure their systems for optimal performance.*** *The combination of 16MB EDO performance DRAM and 256K pipelined burst cache in the Gateway P5-166 Professional system produces blazing speed that processes data by the truckload.*

Why does this particular combination of memory and cache pack such a punch?

Meg: ***Pipelined burst cache and EDO DRAM speed up data delivery to the PC's processor.*** *This reduces the bottleneck created when high-speed processors try to access data from slower conventional memory.*

Amazing. And don't most Gateway PCs come with 16MB EDO performance DRAM?

Meg: *Absolutely. They know what it's like to run 32-bit software apps like the ones in MS Office 95 with 16MB DRAM. It's like driving a Ferrari with a rocket booster.*

Kate: Pop the clutch, Meg! Sydney from Seattle, you're on!

Sydney: *What's all this hubbub about needing 16MB of memory? I thought 8MB was plenty.*

Kate: Get with the program, Sydney! **With 16MB of memory instead of 8MB you get a 25- to 30-percent performance increase. Al from Atlanta, you're on!**

Al: *Hey guys!* ***Not only does Gateway 2000 build extra-fast PCs — they custom-build each system to your exact specifications.***

Kate: Excellent point, Al. Gateway knows that cookie-cutter PCs don't meet the unique computing needs of their customers.

GATEWAY2000

"You've got a friend in the business."

800-216-2796

Kate: Boy, everyone's on a Gateway kick this morning. We must be sending out Gateway vibes!

C'mon Kate — our listeners are smart, and they're up to speed on the PC industry. We have another caller. Lenny from Los Angeles, you're on the air!

Lenny: *Yeah, I'm looking for a computer for my family. I need Microsoft® Word to write about my travels through the Amazon. And my kids want a PC to play games and help them with their homework.*

Kate: There are a lot of excellent home PCs out there. I'd recommend the souped-up version of the 166MHz Intel Pentium® processor-based system we talked about earlier. You need a PC loaded with all the goodies you can find, including a 6X CD-ROM drive for ultimate multimedia performance. Don't even think about a 4X IDE CD-ROM drive in a desktop PC. And you need a large selection of all the latest software versions.

Lenny: *I just read about a computer like that in PC Magazine.* ***They named the Gateway P5-166XL multimedia system Editor's Choice in their February 20, 1996, issue.*** *I thought maybe it was just a lot of hype — but if you guys say that's what I need, I'm a believer! I have to call Gateway right now!*

Kate: Smart choice. *Whoa!* The lines are lighting up. Let's see what Tex from Austin has to say.

Tex: *Yeah, what's all this Gateway talk? Sounds to me like you're biased — big time!*

Biased? Get off that jive, Tex. Ever heard of the First Amendment? We're just providing a forum so our listeners can make a knowledgeable decision when they purchase a computer.

Tex: *Well ... I'm just playing devil's advocate.*

Whatever. Go saddle up your horse or something. Next. Cole from Chicago you're on!

Cole: *What was up with that yahoo?!* ***Doesn't he know that Gateway is one of the few PC companies that provides true "personal computers." Each system is built to order at no extra cost — in fact you have over 15 million configuration options!***

That's a boatload of options! Thanks for the math lesson!

Kate: We have a caller from America's heartland. Hal from Holstein, Iowa, you're on the air!

Hal: *Mega power, Kate! I've been calling your show for years. I can't believe I actually got through.*

Kate: Thanks Hal, what's on your mind?

Hal: *I just bought my first Family PC™ multimedia system from Gateway. I was intimidated at first, but my sales rep, J.T., was very helpful. He helped me custom configure a P5-120 Family PC multimedia system, and he even took the time to tell me about MPEG data compression technology.*

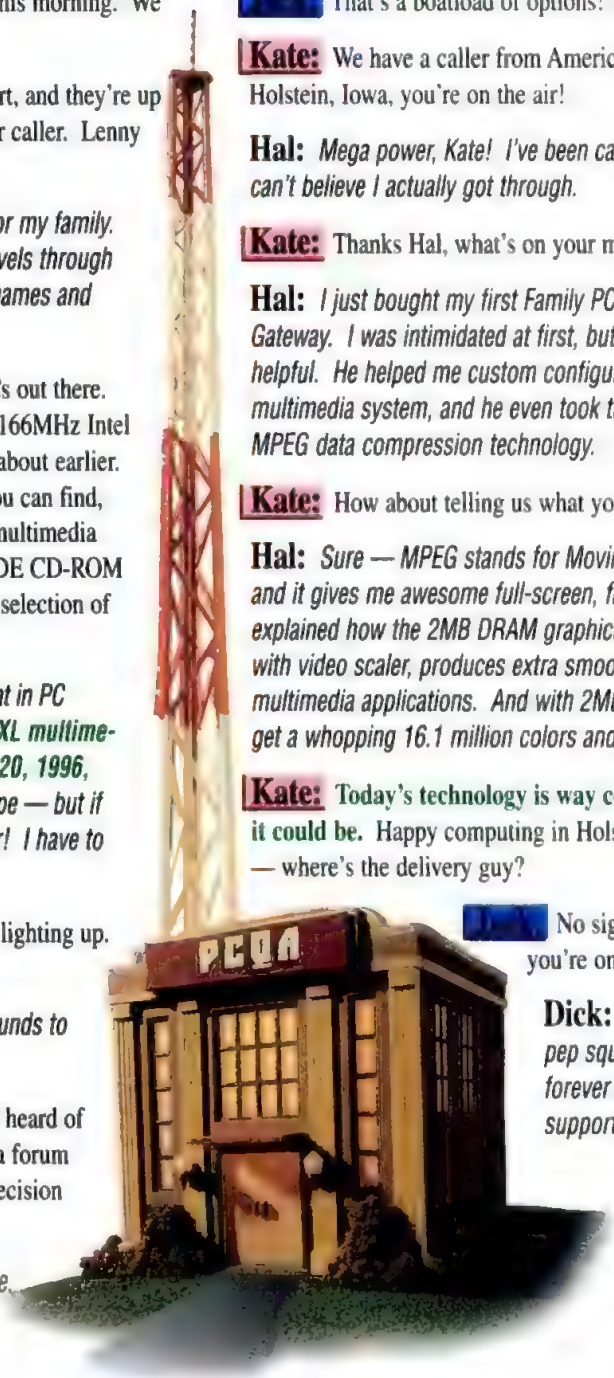
Kate: How about telling us what you know about MPEG?

Hal: *Sure — MPEG stands for Moving Picture Experts Group, and it gives me awesome full-screen, full-motion video. J.T. explained how the 2MB DRAM graphics accelerator combined with video scaler, produces extra smooth video playback for MPEG multimedia applications. And with 2MB DRAM instead of 1MB, I get a whopping 16.1 million colors and a performance boost.*

Kate: **Today's technology is way cooler than I ever dreamed it could be.** Happy computing in Holstein! Hey, that reminds me — where's the delivery guy?

No sign yet. Dick from Detroit, you're on!

Dick: *What are you — a Gateway pep squad? I've heard it takes forever to get through to their tech support.*



OK *Dick* — let's set the record straight. Gateway had a few growing pains awhile back, but last year they beefed up their service with Gateway Gold™ service and support. It features 24-hour-a-day toll-free technical support, seven days a week; free software technical support for all Gateway-provided operating systems and application software, plus much more.

Phil: ***When I decided to go with the Intel Pentium Pro, I couldn't afford not to get the Gateway G6-200. It's specially configured for ultra-high performance.*** *The G6-200 flies through intense applications, and with the Matrox® 4MB WRAM graphics accelerator, I get fantastic graphics performance and 3-D hardware support with more colors.*

Dick: *You win. I'll give them a call.*

We're *so* good! Dee from Denver, you're on!

Dee: *I'm just getting into this computer stuff. I want a PC so I can get on the Net and the Web. Any recommendations?*

An ideal Internet computer for beginners is a Gateway P5-100 Family PC system with 8MB EDO Performance DRAM, a large hard drive, sound capabilities, a 6X CD-ROM drive and a 28.8 fax/modem.

The P5-166XL mulitimedia PC features 16MB EDO DRAM, 2GB hard drive, 16-bit sound card, speakers w/ subwoofer & 28.8 fax/modem for only $3,799.

Dee: *Do I really need a 28.8 fax/modem?*

Absolutely. You don't want to use yesterday's technology to cruise today's graphic-intensive Internet content.

Dee: *OK, you've convinced me, but I'm still a little nervous.*

Relax. **When you buy a Gateway multimedia PC you get a TelePath® 28.8 fax/modem along with the Gateway Info Highway CD.** It has an easy-to-use tutorial of included trial memberships to CompuServe,® Prodigy,® America Online® and Reuters Money Network, plus you get Global Network Navigator for Internet browsing. It's everything you need and more. Don't forget to check out Gateway's Web site at http://www.gw2k.com! Phil from Fresno, you're on!

Phil: ***Man, that Intel Pentium Pro processor pumps out the raw power I need for my graphics and design applications. Now my work is done by mid-afternoon, and I have time to hit the links.***

Now you're talkin'! Tell us more!

Kate: And remember the Gateway G6-150 is now only $3,199! Marge from Minneapolis is up next, and she's ready to talk MS Windows NT.™

Marge: *I haven't heard a lot on your show about Windows NT. It's the only way to go for business apps.*

Kate: How's that, Marge?

Marge: ***We use Windows NT 3.51 at my engineering firm, because it's a powerful 32-bit operating system that efficiently processes our data-intensive applications like those in MS Office 95, Professional Edition.***

Kate: Where do you get this ultra-efficient operating system?

Marge: *We get all our PCs from Gateway 2000. They preload Windows NT Workstation on our systems and configure the needed drivers for compatibility with Gateway hardware and software.*

Kate: Aren't all Gateway PCs loaded with MS Windows® 95?

Marge: *Not anymore. Customers have a choice of Windows NT or Windows 95 on their G6 systems, and Windows NT is available as an upgrade for only $99 on all Pentium processor-based PCs.*

Kate: Thanks for the Windows NT lesson, Marge! And don't forget Windows for Workgroups 3.11 is also available on Gateway Pentium processer-based desktop and portable systems. This is some prize stuff, Jack! Our listeners are educating the masses on how to find the very best values on leading computer technology.

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PC Talk

With Kate & Jack

Jack: I'm really pumped about this review segment. Bob, the controller, is even excited — he's keeping a sharp eye out for the delivery truck as we speak.

Bob: *Jack! Kate! Cow-spotted box alert! Delivery truck at 2 o'clock and closing!*

Kate: All right! Jack's headed for the door to greet Chuck.

Jack: Chuck! Buddy! How's my favorite delivery guy? Let me get my hands on those boxes. Whoa! That one is gigantic!

Chuck: *You've got that right!*

Jack: Thanks, Chuck! See ya tomorrow!

Kate: Let's open the big box.

Jack: Hey! It's a huge charcoal-colored monitor and a wireless keyboard and remote! Did they give us info on this stuff, Kate?

Kate: **No, this is a real mystery. The only clue is this Gateway 2000® Destination™ logo on the front of the monitor.**

Jack: According to this yardstick the monitor has a viewable area of 31 inches! Now my 21-inch monitor looks like a postcard.

Kate: Well, it could be something for presentations or a new tool for video conferencing. Or maybe it's a computing device that could replace the television.

Jack: You just might be onto something, Kate.

Kate: Gateway keeps rolling these new products off the line, don't they? It makes me wonder what else they have brewing up there in South Dakota. I have a feeling it's something spectacular.

Jack: You know I have the same feeling, Kate. What's that, Bob? Ted Waitt, Chairman and CEO of Gateway 2000, is on line three? Ted, you're on the air!

Ted: *Hey, how are you guys doin'?*

Kate: We're great. Say what's up with this Destination stuff?

Ted: *There's some really cool stuff happening in the PC industry right now, Kate.* ***The convergence of the PC, TV and consumer electronics is just around the corner, and all I can tell you is that these products play a big part in all of it.***

Jack: What's your destination in all this, Ted? Are you saying there's a new PC in Gateway's future?

Ted: *We're always coming up with new stuff, Jack.* ***Let's just say there's a revolution on the horizon, and you can bet that Gateway will lead the way.*** *Well, it's been great, but I gotta get back to work. Great show!*

Kate: Wow! I can't believe Ted called us! Well that's enough hoopla for now. I bet the Gateway team put something awesome in our small box, too. Let's open it!

Kate: It's a performance-packed Gateway Solo™ S5-75XL multimedia portable PC. Hey, get a load of this invoice — it's only $2,999!

Jack: Unbelievable! That's an incredible price for a full-featured multimedia portable PC. Value like that is hard to come by in today's PC market, especially on a hot product like this. It's no wonder the December 28, 1995, *Chicago Sun Times* said, "The Gateway Solo is the best multimedia notebook on the market."

Kate: And, according to this press release, all Gateway Solo portable PCs now come standard with modular 4X CD-ROM drives and 10.4-inch SVGA color active-matrix screens.

Jack: Callers, what are your thoughts on the Gateway Solo portable PC? Matt from Montreal, go ahead!

The Gateway Solo S5-120XL portable PC features a 10.4" SVGA color display, 40MB RAM, 1.2GB hard drive, modular 4X CD-ROM drive, 28.8 PCMCIA fax/modem,16-bit sound, speakers and MS Office 95 for only $5,299.

Matt: *I have to admit that's a tempting price tag, but there has to a be a catch. I bet it has a dinky hard drive, almost no memory and low-rent software.*

Kate: You've got it all wrong, pal. The Gateway Solo S5-75XL is outfitted with a roomy 540MB hard drive, 8MB RAM, 256K L2 pipelined burst cache, Microsoft® Works 95 and Windows® 95.

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Multimedia Systems

P5-100 FAMILY PC™

- Intel® 100MHz Pentium® Processor
- 8MB EDO Performance DRAM
- 1.2GB 9ms EIDE Hard Drive
- 1MB DRAM, 64-Bit PCI Graphics Accelerator with MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 16-Bit Gateway Sound Card
- Altec™ Lansing ACS-40 Speakers
- TelePath® 28.8 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- CrystalScan®15 .28dp Color Monitor (13.9" viewable)
- 7-Bay Desktop Case
- 104+ Keyboard & MS Mouse 2.0
- Microsoft® Windows® 95
- Generations II Software Collection
- Gateway Gold™ Service & Support

$1999

P5-120 FAMILY PC

- Intel 120MHz Pentium Processor
- 16MB EDO Performance DRAM
- 1.62GB 9ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator with MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 16-Bit Gateway Sound Card
- Altec Lansing ACS-40 Speakers
- TelePath 28.8 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- Vivitron™15 .26dp Color Monitor (13.9" viewable)
- 7-Bay Desktop Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- Generations II Software Collection
- Gateway Gold Service & Support

$2499

P5-133 FAMILY PC

- Intel 133MHz Pentium Processor
- 16MB EDO Performance DRAM
- 1.62GB 9ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator with MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 16-Bit Gateway Sound Card
- Altec Lansing ACS-40 Speakers with ACS-250 Subwoofer
- TelePath 28.8 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- CrystalScan17 .28dp Color Monitor (15.7" viewable)
- 7-Bay Desktop Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- Generations II Software Collection
- Gateway Gold Service & Support

$2899

P5-166XL

- Intel 166MHz Pentium Processor
- 16MB EDO Performance DRAM
- 512K Pipelined Burst Cache
- 2GB EIDE 10ms Hard Drive
- Matrox® 2MB WRAM Graphics Accelerator w/ MPEG Video Scaler
- 6X EIDE CD-ROM Drive
- 16-Bit Ensoniq® Wavetable Sound Card
- Altec Lansing ACS-400 Speakers with ACS-250 Subwoofer
- TelePath 28.8 Fax/Modem with TAD*
- Gateway Information Highway CD
- 3.5" Diskette Drive
- Vivitron17 .26dp Color Monitor (15.9" viewable)
- 12-Bay Tower Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Generations II Software Collection with Gaming Pad
- Gateway Gold Premium Service & Supp

$3799

** Telephone Answering Device (TAD) gives you complete voice messaging capabilities.*

Professional Systems

P5-75

- Intel 75MHz Pentium Processor
- 16MB EDO Performance DRAM
- 850MB 10ms EIDE Hard Drive
- 1MB DRAM, 64-Bit PCI Graphics Accelerator
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- CrystalScan15 .28dp Color Monitor (13.9" viewable)
- 7-Bay Desktop Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

$1899

P5-120

- Intel 120MHz Pentium Processor
- 16MB EDO Performance DRAM
- 256K Pipelined Burst Cache
- 1.2GB 9ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- Vivitron15 .26dp Color Monitor (13.9" viewable)
- 7-Bay Desktop Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

$2299

P5-133

- Intel 133MHz Pentium Processor
- 16MB EDO Performance DRAM
- 256K Pipelined Burst Cache
- 1.2GB 9ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- Vivitron15 .26dp Color Monitor (13.9" viewable)
- 7-Bay Mini Tower Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

$2399

P5-166

- Intel 166MHz Pentium Processor
- 16MB EDO Performance DRAM
- 256K Pipelined Burst Cache
- 2GB 10ms EIDE Hard Drive
- 2MB DRAM, 64-Bit PCI Graphics Accelerator
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- Vivitron15 .26dp Color Monitor (13.9" viewable)
- 7-Bay Mini Tower Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

$2899

Workstations

G6-150

- Intel 150MHz Pentium Pro Processor
- 16MB DRAM
- 256K Internal Cache
- 2GB 10ms EIDE hard drive
- Matrox 2MB WRAM Graphics Accelerator w/ Video Scaler
- 6X EIDE CD-ROM Drive
- 3.5" Diskette Drive
- Vivitron15 .26dp Color Monitor (13.9" viewable)
- 12-Bay Tower Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows NT™ Workstation 3.51 or MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

$3199

G6-200

- Intel 200MHz Pentium Pro Processor
- 64MB DRAM
- 256K Internal Cache
- 2GB Fast SCSI-2 9ms Hard Drive
- Adaptec® 2940 32-bit PCI Ultra SCSI Fast-20 Controller
- Matrox 4MB WRAM Graphics Accelerator w/ Video Scaler
- 4X SCSI-2 CD-ROM Drive
- 3.5" Diskette Drive
- Vivitron21 Color Monitor (19.9" viewable)
- 12-Bay Tower Case
- 104+ Keyboard & MS Mouse 2.0
- MS Windows NT Workstation 3.51 or MS Windows 95
- MS Office 95, Professional Edition**
- Gateway Gold Service & Support

$6799

*** MS Office 95, Professional Edition includes Word, Excel, PowerPoint® presentation graphics program, Schedule+, Access database and Bookshelf® '95.*

Gateway 2000 Manufacturing, North Sioux City, South Dakota, is ISO 9002 certified.

GSA Schedule
 # GS-00K-94-AGS-5150-PS01

- Microsoft Encarta® 96 ■ MS Cinemania® '96 ■ MS Julia Child: Home Cooking with Master Chefs ■ MS Bob,™ For Gateway 2000 ■ MS Works 95 ■ MS Publisher 95 ■ MS Money 4.0 ■ MS Golf 2.0 ■ MS Music Central™ 96 ■ MS CD Sampler ■ MS Entertainment Packs 1-4 (31 fun games!) ■ Ca$h Graf Home Office Plus™ ■ Mayo Clinic® Family Health Book ■ Mediamatics Arcade™ MPEG Player ■ The Masters®: Interactive Journey Through Its 60-Year History, for MPEG

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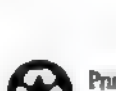

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Hi-Fi Extras!

Multimedia (Sold only with the purchase of a system)

Audio Multimedia Kits

Choose a Gateway 16-bit CD-quality sound card or an Ensoniq® Soundscape™ 16-bit wavetable sound card. Both are Sound Blaster™ compatible and include two Altec™ Lansing ACS-40 speakers.

$95 *(Gateway 16-bit sound card and Altec ACS-40 speakers)*
$155 *(Ensoniq Soundscape 16-bit wavetable and Altec ACS-40 speakers)*

Multimedia Speaker Upgrades

Add the all-new Altec ACS-250 subwoofer for up to 40 watts of additional heart-pounding bass and extraordinary Dolby® Surround Sound.

$75 *(upgrade from systems which include Altec ACS-40 speakers)*

The Dolby® Surround Sound Gateway-exclusive ACS-400 speaker system will make your multimedia applications come alive with true theater-like surround sound. Complete with two Altec ACS-400 satellites and ACS-250 subwoofer.

$120 *(upgrade from systems which include Altec ACS-40 speakers)*

4X Three-CD Changer

Gain access to three times the amount of information of a single CD-ROM with a 4X three-CD changer. ***Ask your sales rep about this exciting upgrade offer!***

Communications & Storage

(Sold only with the purchase of a system)

TelePath® 28.8 Fax/Modem with TAD

Internal fax/modem, 28,800bps modem, V.34, with 28,800bps fax capability. Sends and receives data and faxes, and includes Telephone Answering Device (TAD) for full voice mail capabilities. Includes trial memberships to CompuServe®, AOL and Prodigy® and more! **$149** *(TelePath 14.4 Fax/Modem $79)*

Keyboards (Sold only with the purchase of a system)

AnyKey®+ Keyboard

Any key on this handy 124-key custom keyboard can be programmed to perform any function or series of keystrokes. Plus it features convenient Windows keys for ease of use with Microsoft Windows 95. **$20** *(upgrade from 104+ keyboard)*

Monitors (Sold only with the purchase of a system)

Gateway Vivitron™ Color Monitors

Non-interlaced color monitor using Sony® Trinitron® tube technology, capable of 1280 x 1024 resolution. *(Upgrade prices good only at time of system purchase.)*

Gateway Vivitron15 Color Monitor, .26 dot pitch (13.9" viewable)
Upgrade from a CrystalScan®14 (13.4" viewable) to Vivitron15 **$150**
Upgrade from a CrystalScan15 (13.9" viewable) to Vivitron15 **$65**
Gateway Vivitron17 Color Monitor, .26 dot pitch (15.9" viewable)
Upgrade from a CrystalScan15 (13.9" viewable) to Vivitron17 **$355**
Upgrade from a Vivitron15 (13.9" viewable) to Vivitron17 **$290**

Service & Support

Gateway Gold™ Premium

- Extended Three-Year On-Site Agreement*
- Priority 800 Number For Access To Technical Experts

$99 w/ system purchase **$129** within current on-site service agreement

**On-site service available to most U.S. and Canadian locations after determination by a Gateway tech that you need it. Next business day on-site service is pending parts delivery.*

Gateway accepts most major credit cards and C.O.D. terms, with net 30-day terms and leasing options available to qualified commercial customers. You can also apply for the Gateway 2000 DuoLine™ MasterCard® card, issued by Dial National Bank, Des Moines, Iowa.

Ask About Our "90 Days No Payment" Program!

Networking (Sold only with the purchase of a system)

3Com® Ethernet Adapters

16-bit Triple Media Card with BNC, AUI and RJ-45 connectors **$99**
16-bit Card with only RJ-45 connector **$79**

SMC® ISA Ethernet Adapters

- 16-bit Triple Media Card with BNC, AUI and RJ-45 connectors **$79**
- 16-bit Card with only RJ-45 connector **$59**

Software (Available to both existing and new Gateway customers)

MS Windows® 95 Upgrade

Only available to our valued customers! Windows 95 will make your system faster and easier to use. Order your copy today! **$79** *(On diskettes $89)*

10th Anniversary Software Bundle

Includes BioForge™; Wing Commander® III: Heart of the Tiger™; Magic Carpet™ II: The Netherworlds; and a Gateway 2000 10th Anniversary T-shirt. **$49**
(BioForge may not be suitable for younger children.)

Kid's BackPack™ II

Includes What is a Bellybutton?; The Tales of Peter Rabbit; Cinderella, The Original Fairy Tale; Freddi Fish™ and the Case of the Missing Kelp Seeds™; Pocahontas Reading Adventure, and a Gateway cow-spotted backpack. **$59**

Finance Pack

Includes Quicken Deluxe 5, Quicken® Financial Planner,™ Quicken Family Lawyer,™ and Quicken Parents' Guide To Money™. **$69**

Gateway Gamer's Pack

Includes Command & Conquer™, Virtual Pool™: Straight/8, The Journeyman Project 2®:Buried in Time™, Terminal Velocity™, Primal Rage™, and a Gravis™ GamePad™. **$79**

Printers (Available to both existing and new Gateway customers)

Epson® Stylus™ Color IIs Ink Jet Printer

Photo-quality printing in color and black-and-white. Drivers are compatible with virtually all MS applications. **$259** *(plus $30 rebate for a limited time only)*

Epson Stylus Color II Ink Jet Printer

Perfect for the small business or home office, providing vivid color and crisp black-and-white printing at 720dpi. Plus it's quiet and compact! **$399**

Hewlett® Packard DeskJet 600C Inkjet Printer

The HP 600C ColorSmart technology produces clear, vibrant color with 16.7 million colors to choose from! Black 600dpi printing on plain paper or up to 600 x 300dpi color printing. Includes 34 scalable typefaces. **$259**

Hewlett Packard LaserJet 5L Printer

Add a professional edge to your outputs with 600dpi and HP Resolution Enhancement technology. Fast laser printing at four pages per minute. **$479**

Hewlett Packard LaserJet 5P Printer

Full-featured HP LaserJet printer for your business printing needs. Provides up to 600dpi resolution at six pages per minute. **$849**

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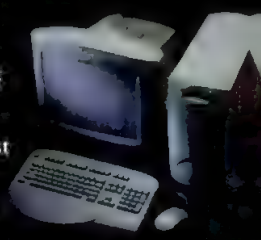
I marched on Washington and never left home.

People in my neighborhood call me the "Million-and-First Man." Because these days, I'm into progress. And empowerment. That's why I hooked up with the Acer® Aspire.™



It helps me do more, for myself and my community. I don't just talk change and betterment. I make it happen. Starting with my own business plan. And the grant proposal that brought in start-up capital. All done with software that came preloaded on Aspire. Aspire also helps me take the word out to the streets. I use the powerful internal fax modem to get politically involved. I get young minds to open up with the high-speed CD-ROM and the power of multimedia. They like the music and the video, and the way Aspire looks. I like the message it sends. Aspire is truly a positive influence.

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Lobby my Congressman via e-mail.

Organize a church fundraiser.

Help local kids apply for scholarships.

And cruise around the Internet.

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and those interested primarily in audio CD creation will be hard-pressed to find a more accommodating package. But until the shortcomings we turned up are addressed, the jury is still out.—*Holly Aguirre*

Deltis CD-R2. List price: $1,289. Olympus Image Systems Inc., Melville, NY; 800-347-4027, 516-844-5000; fax, 516-844-5353. *Circle 450 on reader service card.*

Optima Technology Corp.

DisKovery 650 CD-R

Optima Technology Corp.'s DisKovery 650 CD-R ($1,686 list price with ISA adapter and software, $1,500 on the street) is built largely for professional multimedia and prepress applications, though its bundled software is approachable enough that a wide range of users can use it. Because the midpriced DisKovery is simple to set up and relatively easy to use—and because it was one of the few recorders that successfully and quickly completed most of our tests—the Optima CD-ROM recorder gets a big thumbs up.

The DisKovery's Sony 2X-read/2X-write drive mechanism uses a disk caddy and is enclosed in a notebook PC–size case. The bundle we received also included an Optima ISA/Bus Master SCSI Host Adapter (a private-label version of the Adaptec 1540/42CP), SCSI cable, terminator, SCSI daisy chain cable, Incat Systems' Easy-CD Pro MM 3.0 for Windows 3.1, and five blank disks.

For PC Labs' testing we simply plugged the drive into the test system's Adaptec 2940 card using the included cable. Software installation was also straightforward. Simple to install on our high-powered systems, the DisKovery should be a breeze to set up on other computers as well. The software's minimal requirements include a 25-MHz 386-based machine, 4MB RAM, DOS 4.0, and Windows 3.1. Do note that for a fast data stream, it's necessary to have a 19-ms or faster hard disk with a data-transfer rate of 600 KBps or better.

The bundled version of Incat's Easy-CD Pro worked quickly and well, with only one glitch: Though the documentation covered the creation of disks employing the CD Plus format, we couldn't get it to work in the labs. Optima reported that since the format standard had not yet been finalized, support was not yet complete. On the plus side, it was simple to create backup CDs of the huge numbers of files in our test suites, both on the fly and from an ISO image. You can preview an ISO image of the disk you've created before actually committing it to a CD, though doing so involves booting up a DOS utility. It's a bit of a kludge,

SUITABILITY TO TASK

	Power	Ease
Initial startup	Good	Excellent
Backup	Excellent	Good
Disk duplication	Good	Good
Format flexibility	Fair	Fair

Disk Labeling: The Finishing Touch

You are finally holding your freshly burned CD, which you made all by yourself. Now how do you label it to distinguish it from the rest of your collection? Indelible marker is the quickest, most obvious option, but not only does marker look amateurish, the ink can leak onto the CD, destroying your data. Fortunately, the proliferation of CD-R drives has brought more professional labeling solutions to the marketplace.

At the lower end of the price spectrum is the **Neato CD Labeler Kit** from MicroPatent (800-648-6787). For $79.95, you get a two-part label applicator mechanism (a cylindrical base with a hole in it and a dreidel-shaped dowel rod), template software, and 100 round labels you can pass through your ink jet or laser printer. Additional labels are available in packs of 300 for $60. Neato's template software can be used with any of several graphics programs to make not just the disk labels but custom jewel case inserts, as well.

The Neato is virtually idiot-proof. Place the CD on the dowel rod and lower it onto the label and the base.

High-tech ColorScribe, low-tech Neato.

This product provides an easy and affordable labeling option, but you must be careful that the label has sufficiently adhered to the CD. Any loose edges could damage the CD-R mechanism as the CD rotates.

For a more professional touch, Craig Associates International's (408-254-0395) **ColorScribe 6000** printer may be the product you are looking for. At $2,995, this ink jet unit isn't cheap—but it's much less expensive than the traditional silk-screen or thermal transfer processes, which can cost tens of thousands of dollars.

The ColorScribe connects to any standard parallel port and prints onto the top (non-data) side of the special "printable" CD medium being offered by most CD media vendors. In a single pass, the printer produces full-color text and graphics in anywhere from seconds to minutes, depending on the coverage.

The product comes bundled with Windows 3.1 drivers (Windows 95 drivers were in preparation as of this writing), CorelDraw, and templates you can use to test the alignment of graphics and artwork prior to printing on the actual CD.—*Michelle Schoenung*

but it worked. A convenient ISO override menu lets you ignore ISO filename and directory conventions.

It was simple to copy a commercial CD and almost as easy to record tracks from an audio CD using a cue sheet to list the track before burning. You have to move around the user interface a bit to select proper disk formats. We were able to create a multisession disk with Photo CD tracks and data files using CD-ROM XA format, a test other recorders failed. The CD-ROMs we created in testing passed all our verification tests, including playing audio tracks and running executable files. The drive was also among the fastest we tested, needing less than 22 minutes to complete our On-the-Fly Recording test.

The DisKovery 650 CD-R wasn't the least expensive drive we tested, but it worked very well and in an admirably speedy fashion. Current bundles include Easy-CD Pro for Windows 3.1, Windows 95, and Windows NT. With future support of the CD Plus format expected, this drive should prove a good choice for general users and for its professional target market.—*Bruce Brown*

DisKovery 650 CD-R. List price: $1,614. Optima Technology Corp., Irvine, CA; 800-411-4237, 714-476-0515; fax, 714-476-0613. *Circle 451 on reader service card.*

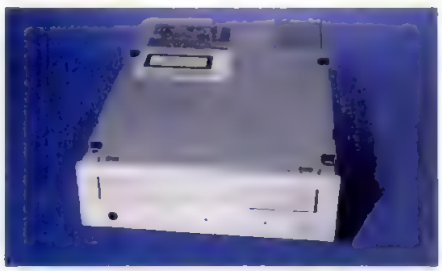
Philips Electronics North America Corp.

Philips CDD2000/20

A complete CD recorder package for about $1,100 street ($1,295 list), the Philips CDD2000/20 represents an enticing offer. The software may not have all the sophisticated options professional CD-ROM developers need—such as Photo CD support or the ability to create hybrid CDs—but it does just about everything else with ease, including backup, archiving, and audio recording.

Fitting into a standard half-height drive bay, the internal version of Philips' double-speed CD-R plays and records disks at 1X and 2X speeds. With it you get an AHA-1540–compatible Adaptec bus-mastering 16-bit ISA SCSI adapter, SCSI cable, Windows 3.1 recording software, and one blank disk. Philips also offers the same drive as an external model with the same features for $1,180 (list).

On our tests we used the included WinOnCD ToGo! 1.4 software for Windows 3.1. The interface is styled after Windows 3.1's File Manager, so it's easy to find your way around. A top window pane displays the source material (usually from the hard disk), while the bottom



SUITABILITY TO TASK

	Power	Ease
Initial startup	Excellent	Excellent
Backup	Good	Excellent
Disk duplication	Good	Excellent
Format flexibility	Good	Good

pane reveals the directories for your CD recording. You simply drag and drop items between them and select Make CD from a pull-down menu.

During backup testing, we found that the software gives you considerable flexibility in dealing with files and directories that don't adhere to the ISO 9660 conventions. You can override the rules, change the filenames on the fly, or discard illegal files. On our On-the-Fly Recording test, the CDD2000/20 managed to record all the data faithfully to a blank CD in a respectable (for a 2X recorder) 25 minutes 34 seconds. You cannot verify the image before recording, but you can choose to "preview" to detect any potential problems, such as exceeding the subdirectory limit of the ISO rules.

The Windows 3.1 software doesn't have a one-button option for copying a CD-ROM, but you can make copies by changing the source drive and dragging and dropping directories from the original CD-ROM. One minor snag we did uncover in making such copies was that during an on-the-fly recording we had to switch on the program's performance test in order to complete a successful recording. Without that enabled, the software hung our test system.

WinOnCD will let you create multisession recordings, including mixed-mode disks containing Red Book audio and regular data tracks. In recording digital PCM files as Red Book audio, it failed to recognize the raw PCM files automatically, but after we changed the file format selection (Intel byte ordering versus Motorola), it worked fine. The only type of audio files the software did not recognize was those using the latest ADPCM compression standard from Microsoft.

At the time of review, Philips was in the process of putting together different software packages for the CDD2000/20. By the time you read this, Philips will be shipping the CDD2000/20 with brand-new bundles for under $1,000 (not based on WinOnCD software). They will be available for both internal and external versions and will address all popular applications up to and including audio and video. Although the company couldn't specify prices and availability at press time, it expected to offer a version with new WinOnCD 3.0 software for Windows 95 users by the end of March. The package is expected to support Enhanced CD (CD Plus) and hybrid disks at that time.

If it works as well as the Windows 3.1 version did for us, it should be an ideal package for business users who want to archive and distribute data on CD-ROM as well as create an occasional multimedia CD-ROM title of their own.—*John R. Quain*

Philips CDD2000/20. List price: $1,295. Philips Electronics North America Corp., San Jose, CA 95110; 800-235-7373, 408-453-5129; fax, 408-453-0680. *Circle 452 on reader service card.*

Pinnacle Micro Inc.

Pinnacle Micro RCD 5020

The Pinnacle Micro RCD 5020, a 2X CD recorder is an attractive buy at $1,295 ($1,100 street). An internal version costs even less ($995 list, $850 street). You get a complete bundle of CD recorder, SCSI board, recorder software, media clip art, and special data backup software that integrates directly with the backup software provided by Microsoft Windows 3.1 and Windows 95. Targeted specifically for business data backup and archive markets, the RCD 5020 is also an appealing package for anyone who wants

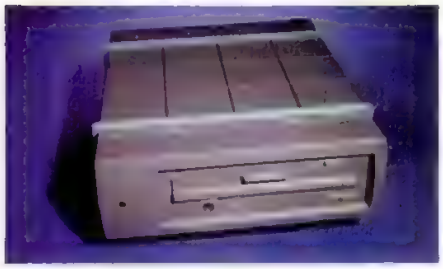
to begin creating original-content CDs. Note that we did run into some compatibility issues on our test-bed, and performance was disappointing as a result.

The RCD 5020 is based on a JVC-sourced mechanism (with firmware upgrades by Pinnacle) and is bundled with an Adaptec AHA-1535A SCSI card with cable and terminator, Corel CD Creator for Windows 3.11 (Pinnacle plans to include Corel CD Creator 2.0 for Windows 95 by the time you read this), and Pinnacle's own RCD Archive, a program using a patented algorithm to allow it to create Microsoft Backup–compatible backup files. Presenters will appreciate the motivational digital video clips (from UP! Multimedia), Corel's Gallery Clip Art Images, and the Best of Corel Stock Photos.

We didn't need to use the bundled SCSI card for testing; the system worked fine plugged into our test system's Adaptec PCI 2940 board. The only other step before getting down to work was to install the recorder software.

Corel CD Creator doesn't support image file creation, so our tests for ISO rules violation and timed file copying were both run in on-the-fly mode. The On-the-Fly Recording test took a long 1 hour 44 minutes (other 2X recorders took less than half an hour), but the drive made an accurate copy.

The drive and software bundle do not currently support Enhanced CD (CD Plus) format, though they reportedly will by the time you read this. The RCD 5020 did perform exactly as required in the multisession Photo CD test, in making multiple audio CD track copies, and in copying a commercial CD. Completing the tasks was easy thanks to the Corel CD Creator, which walks the user through file selection and CD writing.



SUITABILITY TO TASK

	Power	Ease
Initial startup	Excellent	Excellent
Backup	Good	Good
Disk duplication	Good	Good
Format flexibility	Fair	Fair

By the time you read this, Pinnacle may have replaced the RCD 5020 with the RCD 5040, a 2X recorder/4X reader that will sell for the same prices as the current model. If the new drive and software combination improves performance, it could prove a compelling package.—*BB*

Pinnacle Micro RCD 5020. List price: Internal version, $995; external version, $1,295. Pinnacle Micro Inc., Irvine, CA; 800-553-7070, 714-789-3000; fax, 714-789-3150. *Circle 453 on reader service card.*

Pioneer New Media Technologies Inc.

Pioneer DW-S114X

The Pioneer DW-S114X, an external 4X CD recorder sold by the Multimedia and Mass Storage Division of Pioneer New Media Technologies, is targeted specifically for multimedia professionals. The drive, bundled with Incat Systems' Easy-CD Pro for Windows 95 and ten blank 74-minute CDs, lists for $3,495. Neither a SCSI card nor cables are included. The DW-S114X's limitations in completing tasks on our test suite suggest that the Pioneer recorder is best for experienced, knowledgeable pros who may use other software than the bundled program.

Based on Pioneer's own 4X CD recorder, the DW-S114X has more than the usual power and disk activity lights. On the drive's front panel there are also indicators for read, write, and error status. The Pioneer's caddyless design means you don't have to handle an extra piece of paraphernalia when burning disks, which proved convenient.

The DW-S114X is seen by Windows 95 as merely a CD recorder (a Type 5 device) and not as a standard CD-ROM reader (a Type 0.2 device), and therefore could not be used as a data source. Each time the included Easy-CD Pro software loads, it looks for and finds the Pioneer drive, but can use it only as a target, not as a source drive. According to Pioneer, there is other software available that can see the DW-S114X as a reader and as a recorder.

Our rigorous test suite had tasks that got the best of the Pioneer, specifically those tasks that involved many very small files. The thousands of small files overwhelmed the drive and caused it to fall behind, resulting in underruns (and wasted time and disks) even at the slower 2X speed. The drive doesn't support 1X recording, so we couldn't fall back to that recording speed.

It took a significantly long time to write an ISO image file with our test data, but it did work. And burning the CD at 4X speed was relatively fast. Our test for ISO

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rules violations also posed no problems. On the On-the-Fly Recording test, however, the Pioneer suffered underrun errors and failed at both 2X and 4X speeds. A similar problem happened when running the multisession Photo CD test. The PCD files recorded correctly in a first session, but a second session of more than 1,800 small data files resulted in buffer underrun errors, whether the attempt to write the second session used image or on-the-fly mode. Tests to copy Red Book audio tracks and a commercial CD worked perfectly, and both in the speedy 4X mode. The test software doesn't support CD Plus format at this time, but should by the time you read this.

SUITABILITY TO TASK

	Power	Ease
Initial startup	Fair	Good
Backup	Fair	Good
Disk duplication	Fair	Good
Format flexibility	Poor	Fair

The Pioneer DW-S114X's inability to be used as a reader with the bundled software and the problems it had with various CD-creation tasks are significant drawbacks, especially for less experienced users. For the professional multimedia creator who will couple the drive with a more robust premastering package, the Pioneer's higher speed makes it a more appropriate CD-ROM recorder than 2X models.—*BB*

Pioneer DW-S114X. List price: Drive, power cord, operating and installation manuals, $3,295; with Easy-CD Pro, 10 disks, $3,495; with 100 disks, $4,195. Pioneer New Media Technologies Inc., Multimedia and Mass Storage Division, Long Beach, CA; 800-444-6784, 310-952-2111; fax, 310-932-2309. *Circle 454 on reader service card.*

Plasmon Data Inc.

Plasmon CDR4220

With a $1,299 list price and an estimated street price of $1,250, the Plasmon CDR4220 package may seem like an attractive deal. It comes complete with one blank CD, a SCSI adapter, and recording software. Unfortunately, working with its Windows 95 software can be a trying experience. Business users can find a more forgiving and speedier solution elsewhere.

Based on a Philips drive mechanism, the external CDR4220 uses a handy tray design (obviating the need for clumsy disk caddies) and offers the convenience of a mini-headphone jack and a volume control on the front. The 4X-read/2X-write drive comes bundled with a 16-bit ISA Adaptec AVA-1505 adapter with a SCSI cable. It also includes Incat Systems' Easy-CD Pro 1.0 for Windows 95 and Windows NT, as well as Windows 3.1 and Macintosh versions of Easy-CD MM 3.0.

Hooking up the hardware was easy enough, but installing the Windows 95 software for the drive was not the no-brainer exercise it should have been. In addition to separately installing Adaptec's EZ-SCSI software, you must also make manual adjustments to your CONFIG.SYS and AUTOEXEC.BAT files in order for the drive to be recognized by Windows 95. Once installed, the unit is recognized as two devices by the OS: a reader and a writer that are distinct from one another.

In a typical recording session, you select temporary directories, choose an image filename, and drag and drop files into Easy-CD Pro's folder menus. The Windows 95 software can create a true ISO image file on your hard disk. With our test system, though, we were unable to make a successful recording without enabling both the software's preliminary throughput test and the image-creation option. Those extra steps increased the amount of time it took to burn a disk—usually by over an hour and a half. Consequently, those looking for an on-the-fly backup solution may want to look elsewhere. Developers looking to prevent wasted media will also be disappointed to find that you cannot verify a disk image before actually burning the disk. On the other hand, all the disks we recorded with the CDR4220 did prove reliable. You can create single-session, mixed-mode recordings and multisession CD-ROM XA disks, although Enhanced CD (CD Plus) and Photo CD formats were not supported on our tests. The drive also allows you to record digital audio .WAV files as Red Book audio tracks, but it will not convert raw PCM audio files.

One needlessly awkward task we discovered was that in order to copy standard Red Book audio tracks to a blank CD, you must first open Windows 95's CD player, then drag the tracks from the Explorer menu into Easy-CD Pro.

Clearly, additional work is needed to make this version of Easy-CD Pro more user-friendly. Inadequate dialog alerts often leave you in the dark, making it easy for novices to misstep. If you neglect to create a filename for an image you want to record, for example, the program will go through the lengthy testing process before it gives you an uninformative error message that fails to identify the source of the problem.

According to Plasmon Data, updated drivers and firmware should make the CDR4220 Plug and Play–compatible and alleviate most of the installation hassles by the time you read this. However, the quirks we encountered with both the hardware and the software make the current version ill suited to newcomers and to casual business users.—*JRQ*

Plasmon CDR4220. List price: $1,299. Plasmon Data Inc., San Jose, CA 95131; 800-445-9400, 408-474-0100; fax, 408-474-0111; marketing@plasmonca.com. *Circle 455 on reader service card.*

SUITABILITY TO TASK

	Power	Ease
Initial startup	Good	Excellent
Backup	Good	Fair
Disk duplication	Good	Fair
Format flexibility	Fair	Fair

Procom Technology Inc.

Procom PCDR-4X

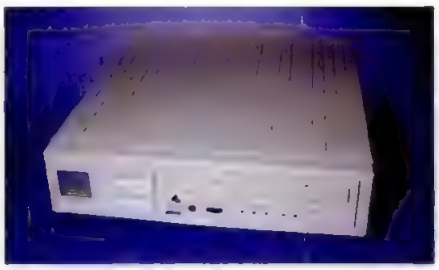
With a list price of $1,699, the Procom PCDR-4X is aimed at corporate users and CD-ROM professionals who want a fast CD-R unit. This product is a Yamaha CDR100 4X-read/4X-write drive, mounted in a well-designed custom external case; ours came bundled with Corel CD Creator and a SCSI cable. While a bit pricey (the Yamaha sells its own external drive for $1,495, minus the cost of the software), the Procom can handle virtually any CD-R task well. The company notes that for the extra dollars you get a fully tested drive and ready support.

The unit is solid. There is a push-in selector switch for setting the SCSI IDs, a real plus over the weak turnposts found on some drives. Five status lights indicate read and write activity, operating speed, and disk status. There are stereo audio input jacks in the rear and an output jack for headphones in the front. The drive uses a caddy rather than a tray to load platters. Connections to the SCSI chain are made with firmly seated 50-pin SCSI-2 Centronics plugs. Procom provides an external termination plug to use if the drive is the last device on the bus. Another nice touch: Users have the option of standing the drive on its side to reduce the footprint.

Our only complaints with the product's construction are its weak door spring and a mushy-feeling loading mechanism (common to all 4X Yamaha CD-R drives). It is hard to tell just when a disk is properly seated, and care must be used not to force the caddy into the slot.

Setting up the unit with our Adaptec 2940 host adapter was no more complicated than attaching the cables, powering up the system, and loading Corel CD Creator under Windows 3.11. Procom plans to include the Windows 95 version of CD Creator once it becomes available, and the company offers an alternative bundle with OMI's TOPiX, neither of which we tested.

The only problems with the drive during our evaluation were imposed by the software. It completed our On-the-Fly Recording test without a hitch, but it took 27 minutes 52 seconds—about twice as long as 4X burner should. Another Yamaha-sourced mechanism in this roundup (from Micronet) running Incat's Easy-CD software turned in an excellent score of only 14 minutes. There is no reason to believe that the Procom would run any slower with the same software, and dealers are free to bundle any premastering software they choose.



SUITABILITY TO TASK

	Power	Ease
Initial startup	Excellent	Excellent
Backup	Excellent	Good
Disk duplication	Excellent	Good
Format flexibility	Good	Fair

On our other tests the drive copied both audio and data CD-ROMs with ease. Unfortunately, the current package won't handle Enhanced CD (CD Plus) or true Photo CD authoring. Corel and Procom claim the new version of the software will.

Procom is well known for high-end value-added mass storage and RAID solutions. Its PCDR-4X recorder comes with a bit of extra care and hand-holding, for a bit more cash. Our only caution is to choose a software package that lets it reach its full potential.—*JK*

Procom PCDR-4X. List price: $1,699. Procom Technology Inc., Irvine, CA; 800-800-8600, 714-852-1000; fax, 714-852-1221; http://www.procom.com. *Circle 456 on reader service card.*

Ricoh Corp.

Ricoh RS-1060C

The Ricoh RS-1060C offers moderate performance for a bargain price ($995 list, $875 street and dropping). Ricoh Corp. has targeted the corporate end user who has modest needs, such as in-house database distribution and archiving. But the recorder can handle audio as well and is certainly suitable for backing up, which makes it well suited for most any individual PC user getting started in CD-R technology.

The hardware side of the RS-1060C is built around Ricoh's own drive mechanism, with a 2X speed for both reading and writing. By the time you read this, Ricoh plans to offer a similar drive that will write at 1X or 2X, boost the read speed to 4X, and let you expand the buffer to as much as 4MB, rather than the fixed 512K of the RS-1060C—all for the same $995 list price.

The current package includes the drive, a power cord, and software. You'll have to get a SCSI adapter and cable else-

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- 16MB EDO RAM/1GB HDD
- 15TX Monitor (13.7" v.i.s., .28NI)
- Integrated 3Com EtherLink III
- Integrated Audio
- 3 Year Warranty

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Product Code #300877

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166MHz PENTIUM PROCESSOR

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- 15TX Monitor (13.7" v.i.s., .28NI)
- Integrated 3Com EtherLink III
- Integrated Audio
- 3 Year Warranty

$3671

Product Code #300878

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where. But once you get the pieces together, installation is a simple matter of plugging in the power cord and cable and installing the software.

The Ricoh drive comes with three premastering programs: Ricoh's own CD-Print 1.2 for Windows 3.1, CD-Print 1.1.1 for the Macintosh, and Incat's Easy-CD Pro MM 3.0 for Windows 3.1.

Ricoh's own software is meant to be easier to use. However, it doesn't offer the same capabilities as the full-function Incat software. In particular, it won't let you create an Enhanced CD (CD Plus) disk, with audio on the first session and data on the second, and it won't let you copy a CD-ROM directly. It also choked on our test data, with 10,000 files in one directory, which forced us to run all the tests with the Incat software.

Easy-CD Pro MM is hard to learn, because the only instructions are in the on-

SUITABILITY TO TASK

	Power	Ease
Initial startup	Fair	Fair
Backup	Good	Fair
Disk duplication	Excellent	Good
Format flexibility	Good	Fair

line help. But once you learn it, the program is straightforward to use. Easy-CD Pro MM handled everything in our test script except for Photo CD format (which it doesn't support) and creating a hybrid CD for the Mac and PC, which needs a Mac-formatted hard disk on the SCSI chain. Performance was more than acceptable for a 2X recorder: 1 minute 43 seconds to index roughly 18,000 files, 9 minutes 2 seconds to create an image file on disk, and 20 minutes 34 seconds to create the CD. Creating the CD on the fly took just over 22 minutes.

Overall, the RS-1060C does a good job of offering what its target market needs—and even a bit more—at a very reasonable price. The Incat software is easy to use, if not easy to learn. And the likely drop in price will make the bundle more of a bargain.—*MDS*

Ricoh RS-1060C. List price: $995. Ricoh Corp., San Jose, CA; 800-955-3453, 408-432-8800; fax, 408-432-9266; CompuServe: GO RICOH. *Circle 457 on reader service card.*

Smart and Friendly

Smart and Friendly CD-R 1002/Pro, Smart and Friendly CD-R 4000/Pro

PC MAGAZINE EDITORS' CHOICE

In the rough-and-tumble world of CD recording, it's nice to find a Smart and Friendly face occasionally. The Smart and Friendly CD-R 1002/Pro and CD-R 4000/Pro, our two Editors' Choices, combine friendly prices with smartly bundled sets of hardware and software from Sony, Yamaha, and Incat Systems. With a list price of $1,099, the CD-R 1002/Pro is a solid entry-level alternative for most individual and small-office CD-recording needs. The faster, more versatile CD-R 4000/Pro ($1,799 list and street) will not let more demanding users down.

The CD-R 1002/Pro is based on a Sony CDU920S CD recorder that can read and write at 2X. The CD-R 4000/Pro delivers higher performance with its 4X-read/4X-write Yamaha CDR100 recorder, but the two bundles are otherwise identical. Each unit comes with an Adaptec 1502 ISA SCSI controller, a "lite" version of Adaptec's EZ-SCSI 4.0 for Windows (3.1*x*, 95, or NT 3.51), and a CD-ROM containing Incat's Easy-CD Backup and CD Workshop utilities along with separate versions of Easy-CD Pro for Windows 3.1*x*, 95, and NT, and for the Mac (System 7 and up). The Easy-CD software worked equally well with both recorders, with one exception: On our tests, the Sony CDU920S could not be coaxed into creating an Enhanced CD (CD Plus) disk with its current firmware.

Both Smart and Friendly units are external SCSI-2 devices that install fairly easily under either Windows 3.1*x* or Windows 95 or NT. Adaptec's EZ-SCSI software includes a wizard application that takes most of the pain out of the process, and all of the Easy-CD products run through their setup routines smoothly and efficiently—a lucky thing, since Incat's manuals are exceedingly thin. There is a wealth of information hidden away in the various Easy-CD help files, but little hard copy supports it.

We conducted most of our testing under Windows 3.11 using Easy-CD Pro MM 3.0, which is more flexible and powerful than the current version (1.0) of its Windows 95 counterpart, which seemed more of a work in progress.

The CD-R 4000/Pro breezed through all of our tests as quickly and efficiently as any unit in the roundup, turning in a top-notch time on the demanding On-the-Fly Recording test (16 minutes 53 seconds). It also successfully created multisession Photo CD and Enhanced CD disks, CD audio from .WAV files or CD-DA tracks, and direct copies of CD-based images from commercial CDs. The 2X CD-R 1002/Pro did nearly as well. It turned in a respectable time on the On-the-Fly Recording test (under 23 minutes).

Incat's Easy-CD Pro for Windows 95 (Version 1.0) boasts a completely revamped user interface that guides you quickly through the recording process, but we found bugs in several of its modules, including an irritating tendency to write to a blank CD during test runs in which recording had supposedly been disabled. The resulting partly written (and essentially useless) disks were dutifully added to our common pool of ruined disks. Incat

SUITABILITY TO TASK

	CD-R 1002/Pro		CD-R 4000/Pro	
	Power	Ease	Power	Ease
Initial startup	Good	Excellent	Excellent	Excellent
Backup	Good	Good	Excellent	Good
Disk duplication	Good	Fair	Excellent	Good
Format flexibility	Good	Good	Excellent	Good

promises major revisions and fixes in its next release (Easy-CD Pro 1.1 for Windows 95), which should be available by the time you read this.

We had no problems backing up files or entire hard disks to a CD with either Easy-CD Pro flavor, but if that's all you need to do, Incat's Easy-CD Backup software is a better bet. Sporting a simple interface that looks at first glance like any standard tape- or floppy disk–based backup program, Easy-CD Backup supports "incremental" and "full" backups, but does not allow you to schedule unattended sessions and does not reset files' archive bits to indicate that they have been backed up. Also, if you want to be able to read an Easy-CD Backup–generated disk on a standard CD-ROM reader, you need to run a Make Disk Compatible process (in between sessions) that eats up 26MB of otherwise usable disk space.

Both of the Smart and Friendly bundles combine solid hardware engines with an impressive suite of recording software. The CD-R 1002/Pro compares favorably with other recorders in its price range. The CD-R 4000/Pro, while also reasonably priced, provides a significant performance boost over its sibling, supports a wider range of formats, and is much better suited to small and midsize business use.—*JH*

Smart and Friendly CD-R 1002/Pro. List price: $1,099. **Smart and Friendly CD-R 4000/Pro.** List price: $1,799. Smart and Friendly, Chatsworth, CA 91311; 818-772-8001; fax, 800-959-7001, 818-772-2888. . *Circle 458 on reader service card.*

Sony Electronics Inc.

Spressa

If the last thing you want to do after creating 650MB of data is spend hours figuring out how to record it, then you'll appreciate Sony's Spressa ($1,499 list, $1,300 street). Designed as a flexible yet easy-to-use recorder for software development, archiving, and data distribution, this external CD recorder was one of the most trouble-free packages we tested. At the time of our review, the software lacked support for some CD formats, but the Spressa deserves serious attention nonetheless.

The 2X-read/2X-write bundle comes with most of the necessary equipment you'll need to start burning CD-ROMs: a SCSI terminator, an audio cable, a disk caddy, Corel CD Creator for Windows 3.1 (Version 2.0 for Windows 95 by the time you read this), and eight blank CDs.

To hook up the Spressa you'll need your own SCSI adapter and cable, but installation couldn't be simpler. Corel's software automatically replaces the standard Microsoft CD-ROM drivers so that Sony's CD-R will be recognized by the system.

The first time out, the Windows 3.1 version of Corel CD Creator will conduct diagnostic tests to determine the maximum throughput on your system. To record CDs, CD Creator creates a "layout" that contains pointers to the files, clips, or audio tracks you want to record. You select items by simply dragging them from a File Manager–style window and dropping them in the target drive's window. Corel CD Creator also lets you rename and rearrange the layout at will. However, the Windows 3.1 version of CD Creator does not allow you to create an image of the planned CD recording on your hard disk; a prerecording check merely ensures that all of the pointers in the layout file are current and accurate.

Backing up typical data files—including applications with filenames that are not ISO 9660–compatible—was straightforward and reliable. In addition, Corel CD Creator lets you copy CD-ROM disks, create your own CD-ROM titles from scratch, and record digital audio tracks in the standard Red Book audio format. On the downside, at the time of our testing CD Creator didn't support the Photo CD and Enhanced CD (CD Plus) formats. You can record mixed-mode disks (those that contain Red Book audio and data), but you must lay them out in advance and record them each in a single session. The coming Windows 95 version will offer Photo CD and true Enhanced CD support.

SUITABILITY TO TASK

	Power	Ease
Initial startup	Good	Excellent
Backup	Good	Excellent
Disk duplication	Good	Excellent
Format flexibility	Fair	Good

Although not the fastest recorder in this group, at 34 minutes 19 seconds to complete the On-the-Fly Recording test, the Spressa is certainly in the ballpark for a 2X drive.

The Spressa merits attention based on

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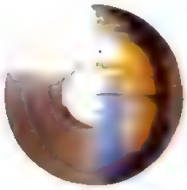

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its ease of use alone. Of all the CD-R bundles we tested, we had the fewest snags with this setup, and with eight free blank CDs and Corel CD Creator 2.0 for Windows 95, business users may find it to be one of the most flexible CD-R packages for the money.—*JRQ*

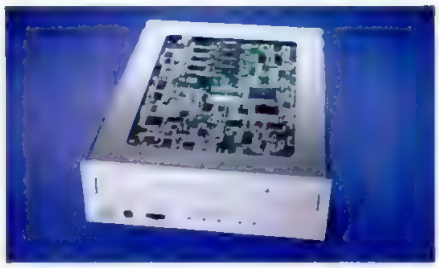
Spressa. List price: $1,499. Sony Electronics Inc., San Jose, CA; 800-352-7669, 408-432-0190; fax, 408-955-5171; http://www .sony.com. *Circle 459 on reader service card.*

Yamaha Systems Technology Inc.

Yamaha CDR100

The Yamaha CDR100 ($1,495 list) is a virtual standard when it comes to high-speed CD-R drives. This internal drive was the first 4X-read/4X-write drive on the market and appears in a variety of VARs' products, including jukeboxes, arrays, and five of the kits reviewed in this roundup. Unlike most bundles that include the drive sold by third parties, Yamaha does not add any software or SCSI adapters. You get the drive and a manual. Yamaha reports that VARs and retailers often bundle software before selling the product to the end user.

The unit fits in a half-height 5.25 inch drive bay, and has an array of lights on the front indicating disk status, read and write activity, and the current operating speed (either 2X or 4X). There are also controls for volume and disk ejection and a headphone jack. The rear panel has jumpers for SCSI ID, parity, and termpower, as well as an audio-out jack for connection to a sound card. The manual is well written and complete, covering both setup and long-term care of the product. It was better than the ones shipped by several of the other suppliers of the same drive.



SUITABILITY TO TASK

	Power	Ease
Initial startup	Excellent	Excellent
Backup	Excellent	Good
Disk duplication	Excellent	Good
Format flexibility	Good	Fair

Our only complaint with the drive was not in its operation but in its construction. During installation we had to adjust settings, and the opening is so small that you need a tool to move jumpers. Once the unit was in the computer we found another issue. The disk seating mechanism works like some VCRs: You push the caddy in part way, and a mechanical transport device takes over. This feature failed on our first drive during testing. It was hard to tell just when it takes over, or how much pressure to use. The caddy would drop, but it wouldn't position the disk properly.

Since no software shipped with the drive, we tested the CDR100 with Corel CD Creator under Windows 3.11. The CDR100 handled our tasks that were software-supported without problems. The software we chose was unable to produce CD Plus, true Photo CD, or hybrid PC/Mac CDs, but the drive itself is capable of supporting those formats.

Backup sections of the test suite were completed properly, but the aging Corel software did not show off the CDR100's full potential. Paired with the Incat package, the CDR100 gave the best times in the lineup, but with the Corel software Yamaha recommended it finished in the middle of the pack (almost 28 minutes for the On-the-Fly Recording test). Corel will have a new 32-bit version out by the time you read this. Informal evaluations seem to indicate that the new edition of CD Creator offers much better performance than the current one, but exact comparisons will have to wait for its release.

The Yamaha CDR100 overall is a well-designed drive with a few minor shortcomings. Its popularity means that drivers are available with all the major software packages. Our tests point out that selecting the right companion product will determine not only what formats you can record but how fast the job can be handled. The CDR100 is an excellent starting point.—*JK* □

Yamaha CDR100. List price: $1,495. Yamaha Systems Technology Inc., San Jose, CA; 408-467-2300; fax, 408-437-8791. *Circle 460 on reader service card.*

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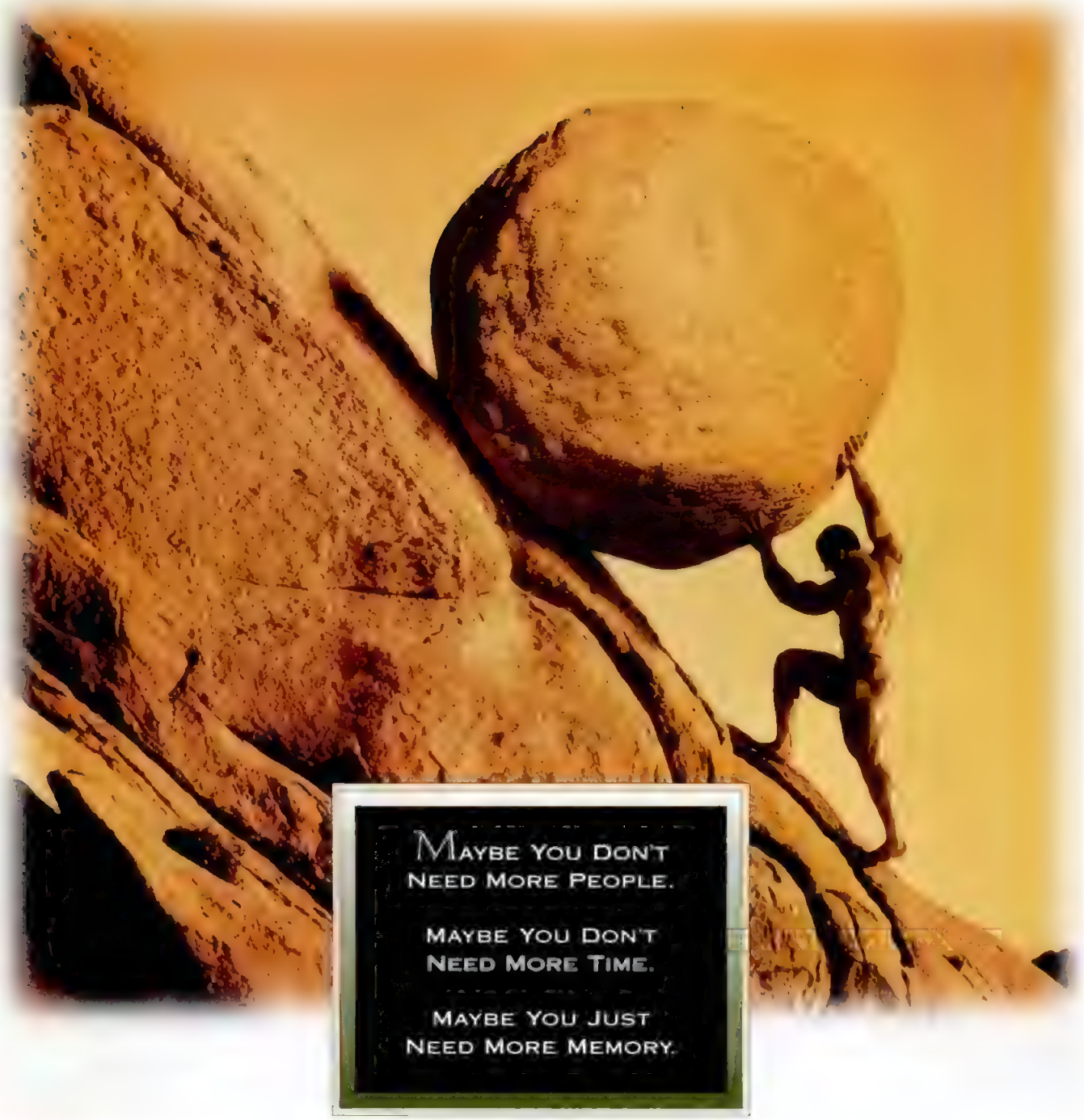
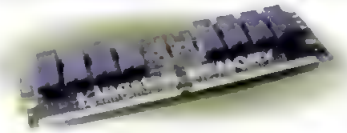


These days, you can sum up the human condition like this: too much work, not enough time. Computers, of course, are supposed to ease the burden. But now, with all the new memory-hungry software out there, many computer systems aren't up to the task. Fortunately, there's a simple solution: add more memory. Recently, an independent study* revealed that by adding just four megabytes of memory, the average manager became 26% more productive. The average number cruncher improved by 12%. So, why Kingston memory? Because Kingston makes memory for almost every PC, server, printer, and workstation known to man. Our memory is designed to meet, or even exceed, the specifications set by leading computer manufacturers. We test every cell on every chip on every module. (On a 16 megabyte module, that's 128 million cells.) If you ever need help, our service and support will quickly shoulder the load. Is it any wonder Fortune 1000 companies use Kingston memory more than any other brand?



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CD CREATE YOUR OWN

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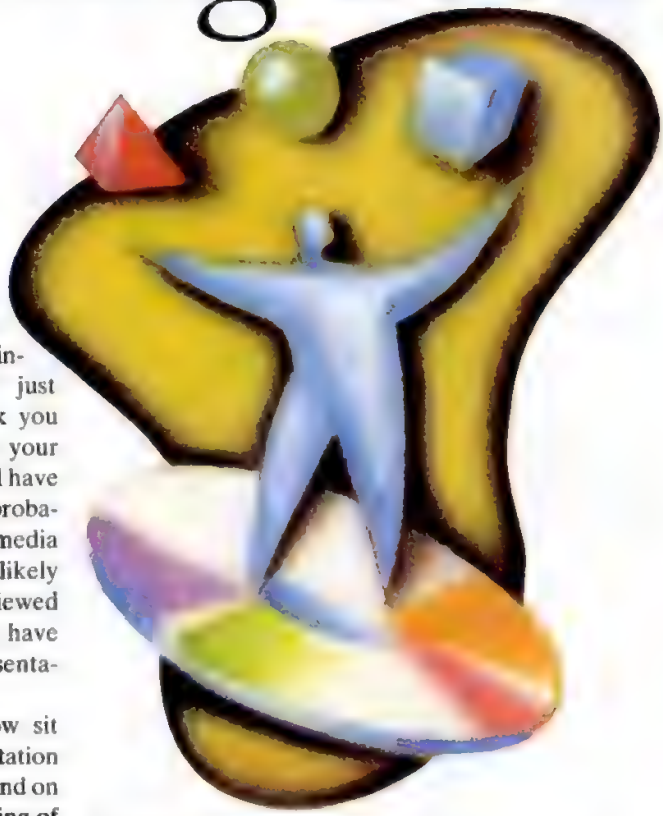
Multimedia Authoring Tools



By Linda and Erick Von Schweber

What do the Sony multimedia CD-ROM catalog, the Windows 95 training application you just studied, and the kiosk you looked at to navigate your way around the mall all have in common? Each was probably built with a multimedia authoring tool (most likely one of the nine reviewed here). Could any of these products have been created with a multimedia presentation program? Probably not.

Multimedia authoring tools now sit squarely between multimedia presentation programs such as Gold Disk's Astound on one side and the custom programming of commercial multimedia titles (like games or encyclopedias) on the other. The difference is that authoring environments let developers create applications with sophisticated interaction: The user can navigate by clicking objects and hot spots, choosing from groups of answers, dragging and dropping objects to make selections, and even entering free-form text or numeric responses.

Authoring is about creating highly interactive applications in which information flows both ways: from application to user and from user to application. Presentation programs are primarily for communicating information in one direction, from application to user, with the users' interaction limited to navigation.

Sound, video, animation: Bringing together the diverse pieces of a dynamic multimedia event has never been easier.

Multimedia authoring tools have grown up, and a new generation are poised to transform the landscape of personal computing. When we last looked at this category ("Creating Multimedia to Die For," February 22, 1994), many programs required the skill of a professional. Today, creating higher-quality audio and video

needs little expertise, and mere mortals can develop cool multimedia apps. It should be noted, however, that our focus, and that of much of our testing, was on *business-related* CD-ROM development. In other words, we paid most of our attention to computer-based training, data collection, and conditional branching.

THE BIG PICTURE

Authoring shouldn't require a team of programmers. Instructors, corporate communicators, and content specialists who don't have previous programming experience should all be able to learn and use the authoring environment. In testing, however, we found we could group authoring programs into two distinct types: those that relied entirely on point-and-click and those that required simple scripting. If you never want to write even a single line of code, take note and choose your tool accordingly.

To evaluate these multimedia authoring tools, we ran them through a gauntlet of tests on a Hewlett-Packard Pentium-class system. Our tests included the creation of noninteractive multimedia, computer-based training (CBT) applications, catalog creation, and even authoring for the World Wide Web.

Don't get the idea that audio and video are just standing still. With 16-bit wavetable sound, the applications we authored sounded better than ever. Video technology is changing, too. MPEG produces full-screen, 30-frame-per-second video, a big change from the postage-stamp-size .AVI output we saw in our 1994 evaluation. Most of the programs we examined can control MPEG playback boards through MCI commands.

NEW PARADIGMS AND FORMATS

Many vendors of authoring products have discovered the advantages of object-oriented programming, though none have developed a fully object-oriented program. Everest Authoring System offers object instancing, while MediaVerse and Oracle Media Objects let you add new methods and events to existing objects. Supplied templates in Authorware and MediaVerse save you time in implementing specific functionality.

Where do you put your multimedia app when it's done? The related story, "Create Your Own CD: CD-R Drives" in this issue examines the reality of placing your production on a CD. But you can also post it on the World Wide Web. Without a doubt, most of these authoring programs will soon serve as Web authoring tools and more, as Macromedia Director and IconAuthor already do.

MULTIMEDIA REDEFINED

While the traditional workhorses of authoring have matured, a new collection of media, programs, and formats have arrived on the scene—or will arrive in the near future. Among new media types, the most exciting is 3-D, supported by today's high-end graphics boards from Creative Labs and Diamond Multimedia, as well as by RealityLab software from Microsoft.

Strata's MediaForge (second release), Oracle's Media Objects 2.0, and mFactory's mTropolis Windows release will all include authoring support for 3-D in the form of VRML (Virtual Reality Modeling Language). In these environments, 3-D will become just another media object, like today's bitmaps, buttons, and list boxes.

The revolutions now taking place in

Our Contributors: STEPHEN W. PLAIN and LUISA SIMONE are contributing editors of *PC Magazine*. PAULINE ORES is a freelance writer. LINDA and ERICK VON SCHWEBER are frequent contributors to *PC Magazine*. PETER MCKIE is the executive editor of *PC Magazine CD*. BEN Z. GOTTESMAN is a technical director, DAN SMITH is an associate project leader, and ARIE MOLLER is an editorial researcher at *PC Magazine*. LANCE N. ULANOFF was the senior associate editor in charge of this story.

MULTIMEDIA AUTHORING SOFTWARE

How to Read the Suitability to Task Boxes

To create effective multimedia, you need tools that can handle a wide range of authoring tasks, including interactive title development, CBT, interactive catalogs/kiosks, and Web authoring. We evaluate each product's power and ease of use in the context of four tasks designed to address these issues.

Our CD-ROM **interactive title development** task focuses on the flexibility and power of screen design tools and the intelligence and support for managing memory requirements and playback data rates. We also look at each product's ability to create cross-platform applications.

Because creating **computer-based training (CBT)** is so complex, this task stresses wizards, templates, and other tools designed to make it easier for nonprogrammers to generate applications. Other features we look for included the ability to interface with a database—either proprietary or via ODBC—for tracking student performance, and special tools designed for creating exercises. These types of applications are generally developed and used within corporate environments.

SUITABILITY TO TASK

	Power	Ease
Interactive title development	Poor	Poor
Computer-based training (CBT)	Fair	Fair
Interactive catalogs/kiosks	Good	Good
Web authoring	Excellent	Excellent

N/A—Not applicable: The product does not have this feature.

Because the ultimate goal of **interactive catalogs/kiosks** is to sell things, we look for products that offer robust database-handling tools for processing sales transactions. We also examined the complexity of each multimedia application's programming language and the ability to plug new data, graphics, and media into the old program structure on a repeated basis.

Our **Web authoring** task involves generating an application that can be played by a helper application from within a Web browser, or something as complex as a standalone application designed to stream data from the server over TCP/IP connections and onto the user's browser without making the user download the application.

multimedia authoring represent a fundamental change in the applications we will be creating. The interactive excitement and graphics adventure of today's best computer games will soon weave their way into our personal control, letting us produce gamelike online catalogs, kiosks, titles, training applications, and home pages that entertain as they inform. The winds of change are in the air.

Macromedia Inc.

Authorware

In 1994, Macromedia's Authorware and AimTech's IconAuthor shared our Editors' Choice award for multimedia authoring software. Like IconAuthor, Authorware has since matured, and its most visible flaws have been fixed.

Priced at $4,995, Authorware 3—a 16-bit product that runs on Windows 3.1—is now a dependable, industrial-strength environment that allows multiple people to contribute to an application. Artists can load a library with media, programmers can provide templates for complex interactions, and interface designers can put everything together. And one nonprogramming designer can even do the entire job alone.

The icing on the cake? Authorware 3 lets you author programs in identical environments on either the PC or the Macintosh and produce runtimes (royalty-free) for either.

Authorware 3

List price: $4,995.
Requires: 386/33-based PC or better, 4MB RAM, 20MB hard disk space, Microsoft Windows 3.1 or later, VGA card, 2X CD-ROM drive. **In short:** Authorware's unique interface allows nonprogrammers to construct complex applications easily without writing a single script (not even "on button up") Pretty powerful stuff
Macromedia Inc., San Francisco, CA; 800-756-9603, 415-252-2000; fax, 415-626-0554; http://www.macromedia.com. *Circle 461 on reader service card.*

SUITABILITY TO TASK

	Power	Ease
Interactive title development	Good	Good
Computer-based training (CBT)	Excellent	Excellent
Interactive catalogs/kiosks	Fair	Fair
Web authoring	N/A	N/A

N/A—Not applicable: The product does not have this feature.

Corporate multimedia authoring:

IconAuthor

Interactive title development:

Macromedia Director

In the past few years, we've witnessed increased interest in multimedia authoring, thanks to the proliferation of CD-ROMs on the PC. At the same time, corporations have come to realize that the multimedia used to entertain can also teach and train.

Although these tasks may at first appear to require a wide array of tools, we think that one of two powerful products can fill most if not all of your multimedia authoring needs. Consider our Editors' Choice selections, AimTech Corp.'s IconAuthor 7.0 and Macromedia Director 4.04.

With IconAuthor, AimTech has managed to upgrade its venerable corporate-level multimedia application-building tool without losing sight of the qualities that made it an Editors' Choice in our last evaluation.

Though still icon-based, IconAuthor took new strides with its SmartObject Editor, which now controls the objects so critical to multimedia application creation. AimTech had introduced SmartObject Editor in Version 5.0, but we were pleased to see the central role it now plays in this latest version. Put simply, SmartObject Editor takes disparate items like pictures, video clips, animations, text, push buttons, and list boxes and assembles them all into icon layouts that work.

And you can now build complex multimedia with finesse in IconAuthor, thanks to object properties boxes, which you can assign to each object type. In addition, AimTech's successful implementation of ODBC connectivity in IconAuthor outshines the attempts of other products.

One broad complaint also applies to other competent products, such as Macromedia's Authorware. The days of paying nearly $5,000 for an effective authoring tool should really be over. Oracle's $495 Media Objects proves it.

It should come as little surprise that the seemingly ubiquitous Macromedia Director ($1,195) walks off with our Editors' Choice for interactive title development. Though its database support falls below the level that creators of training tools need, Director deserves acclaim on a number of counts: Not only is it the only application reviewed here that offers binary compatibility between Windows and Macintosh multimedia creation files, but it also handles animation routines and scene creation better than any other tool we saw. And with Shockwave, its Internet tool, Macromedia is pushing the envelope in Web authoring, too.

To construct PC Labs' test application, we dragged icons to the *flowline*, placed graphics on the display screen, and filled in dialog boxes. We came to see the flowline as an outliner of sorts, especially because Authorware groups icons into maps that fit onto one screen. This keeps the flowline comprehensible at all times. You study your "code" by drilling down through the icons to your dialog box settings. This flowline is not like IconAuthor's, where each icon represents one small bit of a program. Authorware's icons hold a wealth of programming information that never requires you to think like a programmer.

MANIPULATION

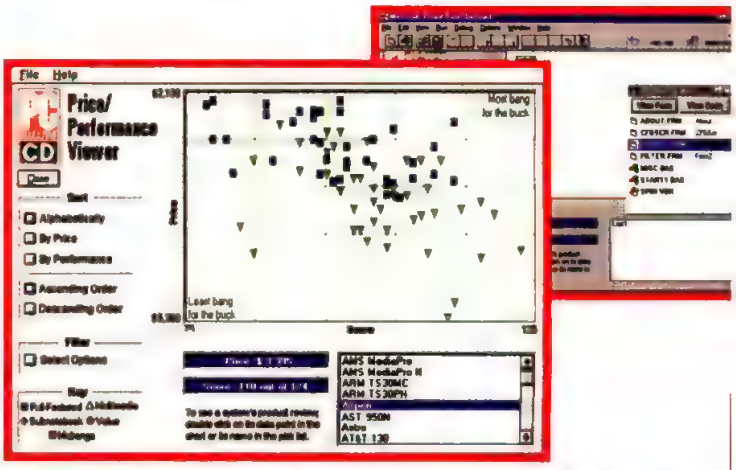
Some icons allow you to manipulate media on the screen. They can display and erase graphics, move or animate objects, play .AVI and QuickTime digital movies

How We Create PC Magazine CD

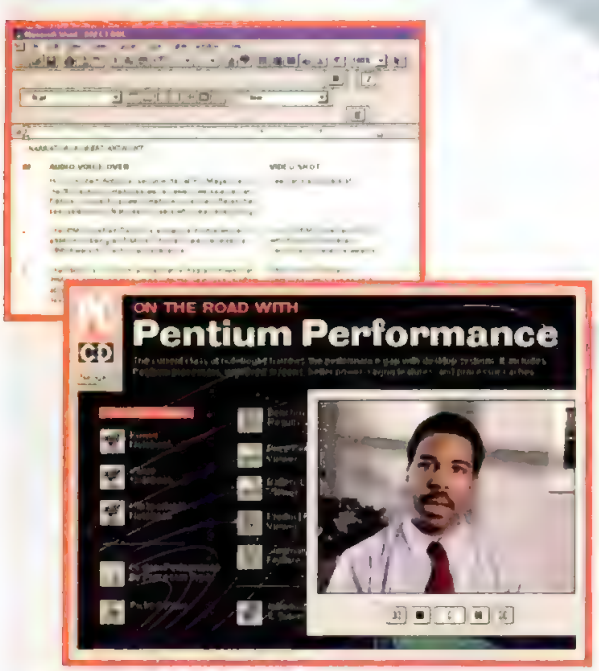
By Peter McKie

PC Magazine CD is a quarterly on-disk magazine that overlays our product reviews with multimedia components to give readers a richer experience with those products.

VOICE-OVER: We develop our editorial content using a variety of multimedia authoring tools. For example, when we review a new piece of software, we use a tool such as Lotus ScreenCam, which records screen images and voices simultaneously. Reviewers can walk readers through a product as they discuss its attributes, and readers come away feeling as though they were standing over the reviewers' shoulders. ScreenCam produces royalty-free .EXE files that we link to a hot-spot icon on the CD's electronic page



USER-DEFINED: We provide tools that let you manipulate benchmark test data. Our interactive Price/Performance Viewer, for example, lets you narrow in on a product's attributes. We have custom-programmed each of these tools in Visual Basic for PC Magazine CD.



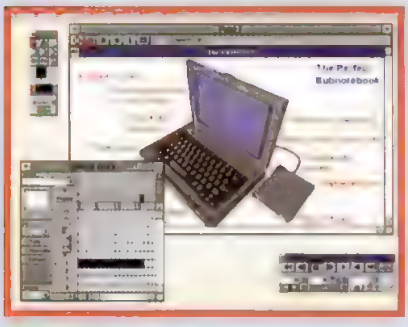
TALKING HEADS: Some product categories, most often hardware, require other content solutions because they don't lend themselves to screen-image recordings. Still, we want readers to "experience" each product, so we take a more conventional route to content development: full-motion videos. We write a script that describes the product's pluses and minuses, and our video crew then shoots from that script. We edit the raw footage, digitized and captured as an .AVI file, on an AVID video-editing machine. Then we link the file to a hot-spot icon on the CD's electronic page that plays through Microsoft Video for Windows

BURN IT: Once we've developed all the content, we burn the alpha, beta, and finally the gold master disks—and perform quality-control testing after each generation. The master disk then goes to our reproduction facility, Cinram

ON THE SHELF: Meanwhile, we design the CD-ROM packaging, which includes newsstand and subscriber boxes

PAGE BUILDER: We design highlight screens and objects like buttons in Adobe Photoshop. We add all the functionality later.

We use MediaVerse as the database shell for the CD; it holds all of the CD's data in individual bins (say, a bin for text files, one for graphics files, one for videos, and so on). We then use a customized C++ program code to call individual files from within the bins and display them in appropriate positions on the CD's electronic page.



INTERACTION: We build interactive scenes with Macromedia Director. This allows end users to make selections during the course of the presentation and supports branching to other topics.

THE FINISHED PRODUCT: Our printing/manufacturing facility, AGI, assembles all the elements and inserts the disks into our packages, which are then boxed and shipped to our distributors.

as well as .WAV sound files, and access videodisk and videotape players. Sliding our title onto the opening screen required simply setting up a display icon, typing the title, and dragging a move icon beneath the display icon on the flowline. And interaction icons were perfect for our drag-and-drop game. We loaded our composer bitmaps into display icons and set their attributes to *draggable*, then dragged each bitmap to its correct location.

Creating and scoring drag-and-drop games in Authorware is as easy as drawing the drag-to area on the screen and choosing Correct Response from the dialog box.

The new framework icon automates hypermedia interactions and provides a default navigation structure. What does that mean? Well, if you have a ten-page document in rich text format (RTF), you can import it into the first "page" of a framework. Authorware can create a new display page for each hard page break in your RTF file. Eight buttons allow you to move between pages, pop up a pick list of pages you came from, search documents, and exit the framework.

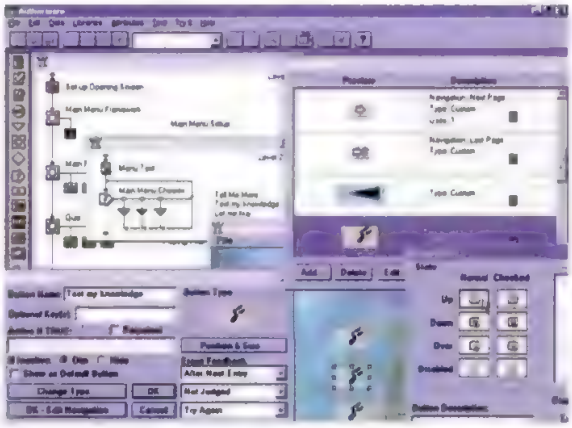
Authorware 3 has added text styles that you can apply to any text (labels, menu options, scrolling text boxes). We defined a "hot" style, applied it to individual words, sentences, and paragraphs, and immediately we had hypertext! A style box lets you define interactivity: for example, using one or two clicks to highlight the hypertext, changing the cursor, and the like.

DESIGN AS YOU GO

Starting with our script and storyboard, we were able to design in Authorware as we went along, and we received immediate feedback as we tested our application. Flags let us test small segments at a time. New debugging tools include a Trace window, which shows every command issued by or to the application, and a Show Connections window, which navigates between icons. Creating, displaying, and tracking the use of variables is child's play. Authorware elegantly provides full data integrity for its naming of icons and variables. Change a variable name and it changes everywhere it's used.

Authorware can run timers, change the flow in response to a user, keep score, and access laserdisk players via a dialog box. On the downside, you still must write MCI code to play MIDI files or audio CDs. And although Authorware includes ODBC to enable connectivity to and from databases, it falls short of enabling proper database interactivity and reduces each fetched record to a single text string.

Although we were able to complete the order form in our PC Labs test script, we do not recommend Authorware for serious database interaction such as interactive catalogs. But even though Authorware ships with a full assortment of buttons, dialog boxes, sliders, gauges, scrolling text boxes, and data entry boxes,



Authorware ships with 14 standard and custom navigation buttons. You define your own by assigning a different bitmap for each button position.

it lacks such features as the critical list and combo boxes that we used in other programs to create the order screens.

The new documentation and online help are comprehensive and easily comprehensible. We found everything we needed, from extensive explanations of the various icons to samples of all. And Authorware 3 ships with a coupon for a free copy of Director Studio (see the review of Macromedia Director). Authorware's native Windows 95 rendition, Version 3.5 (due this spring), will include Shockwave for Authorware, which streams applications across the World Wide Web.

Authorware rewards an open mind and a willingness to tackle its different approaches by giving nonprogrammers accessibility and allowing them to produce complex interactivity with a minimum of programmer-like thinking. Whether you want to create kiosks or CBTs, Authorware's built-in knowledge of interaction, testing, and scoring makes it a mature and bulletproof environment.—*Linda and Erick Von Schweber*

Intersystem Concepts Inc.

Everest Authoring System

Developers of CBT applications who seek a powerful but easy-to-use Windows-based authoring environment should take a serious look at Intersystem Concepts' $4,395 Everest Authoring System 1.5. As far as CBT environments go, Everest—a Windows 3.1 application that also plays back on Windows 95—features strong multimedia support, enough object orientation to improve your productivity over competing products, and great tech support.

Everest's nearly seamless multiparadigmatic approach includes such features as visual programming with icons, direct manipulation of interface elements, and procedural programming. Everest has successfully integrated these elements, making applications development easier.

CLIMBING EVEREST

The Everest development environment opens with multiple views of your application. Supporting all these paradigms takes up screen real estate, so we suggest running Everest at a minimum of 1,024 by 768 pixels. The display includes VisualScreen (which shows what your audience will see), the IconScript window of program icons, Attributes windows, the Toolset window, the Apex program editor, an excellent debugger, a Variables window, and the Everest main menu bar. You may want to consider running display resolution at 1,280 by 1,024 pixels!

Highlighting the catalog button on Everest's VisualScreen brings up its attributes and highlights its location.

In Everest's application creation, you start off with a library and name an initial screen. Dragging a Layout object icon

GLOSSARY

Understanding Multimedia

Branch Any one of the paths an application can take after it evaluates a specific condition.

CBT (computer-based training) A method usually used in corporations and academia to help nonprogrammers generate applications.

Debugging Executing a program, one statement at a time, to identify and fix errors.

Event handler A special type of function that executes automatically when a particular user-enabled, system-enabled, or code-generated event occurs.

Execution flow The section of code that the application executes, depending on branching decisions.

Function An instruction to the application that performs operations or returns a value, or both.

Hot spots Buttons or other programmable objects that can activate objects or linked events.

Kiosk A center of standalone interactive information or content.

Loop A set of statements in a program executed repeatedly, either a fixed number of times or until a specified condition is true or false.

MCI (Media Control Interface) A standard control interface for multimedia devices and media files, including a command-message interface and a command-string interface.

MPEG A digital video standard developed by the Motion Pictures Experts Group.

ODBC (Open Database Connectivity) support Access to the database programming interface from Microsoft Corp. ODBC provides a common language for Windows applications to interact with various databases, locally and on a network.

Palette A table of available simultaneous colors that paints pixels on the screen.

Score A sequence, either time-based or frame-based, that determines the timing of a presentation and the synchronization of its objects.

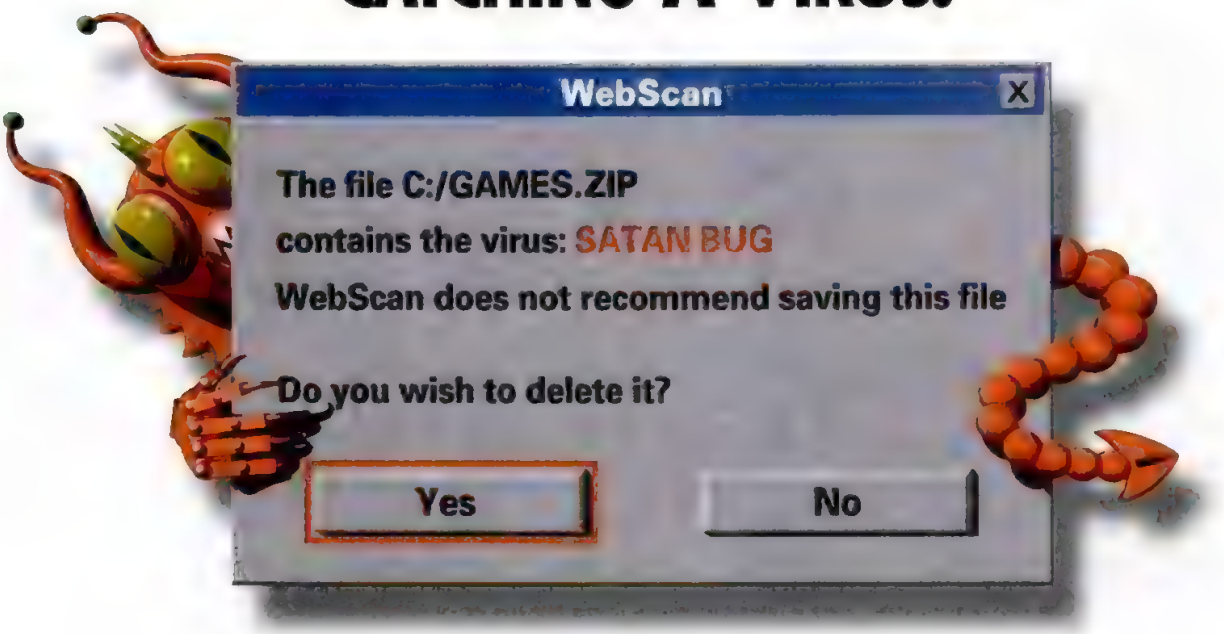
Sequence A combination of events executed in a predetermined order.

Sprite An independent graphic object that moves freely across the screen.

Time line A graphical representation of a span of time and the chronological relationship of events.

Variable A named container that holds values, either numeric or text.

How To Catch Web Fever Without Catching A Virus.



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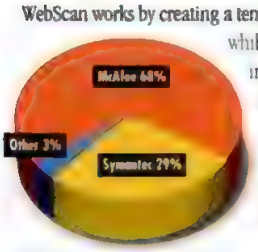

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CIRCLE 299 ON READER SERVICE CARD

A Brief Look into the Near Future

By Linda and Erick Von Schweber

A number of authoring products were not shipping at review time but are interesting enough to warrant sneak previews.

Three major changes greet the developer in the upcoming release of Global Information Systems Technology's (800-327-0565, 217-352-1165) TIE (Training Icon Environment) Authoring System, Version 5.0 ($3,500 list price): Object Oriented Tutor, a new architecture that coexists with the old; "Strategies," or templates, for TIE applications; and HyperWindows, a TIE Strategy that eases multimedia incorporation.

The fish—a multiframe, mFactory animation object—is on a path in a tank object.

First, TIE's Object Oriented Tutor might not be what you'd expect. The architecture most closely resembles the "blackboard" systems that perform speech recognition. With Object Oriented Tutor, objects send messages not to one another, as in a true object-oriented language, but to a blackboard, called the *message queue.*

"Strategies," templates shipped with TIE, shield the developer from the complexities just discussed. The documentation we saw presents three templates. The Strategy for drag-and-drop seems complete but limited: The developer can provide the end user with no more than three attempts to figure out the right answer.

The HyperWindows Strategy eases the use of multimedia. Past versions of TIE required MCI to invoke media. One or more Hyperwindows can be launched from the main TIE application. Each Hyperwindow can show text, animation, or a bitmap, or it can play digital audio, video, or a videodisk.

Are you in the market for a tool with entry-level ease, a visual punch beyond that of the best presentation program, the flexibility of a high-end authoring environment, and the power of 32-bit, multithreaded programming? Strata's (800-787-2823, 801-628-5218) new entry in the field, MediaForge ($1,495 list), which should be shipping by the time you read this, looks to be all this and more.

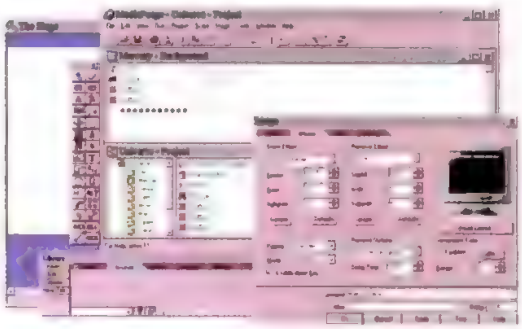
MediaForge is essentially a visual front end to Strata's MediaBasic, an extension of Basic for multimedia. It's amazing, however, because Strata's built-in functionality requires no explicit coding. Some examples include transitions and effects beyond those of any other products; easy use of pick, drag, and drop as a selection method; video "keying"; and a sprite engine that selects the correct images for an animated character to move in any of nine directions.

How about placing a task on its own thread of execution so it can run asynchronously? MediaForge, a 32-bit application for Windows 95/NT, makes this a simple, dialog-box pick. Want to author for the Web? Strata will include a Netscape plug-in enabling MediaForge to act as a Web authoring tool. Need database connectivity? MediaForge's ODBC sounds promising.

Don't let mFactory's little *m* fool you—this is *big* news. The January introduction of mTropolis for the Macintosh ($4,495 list), with a 32-bit Windows 95/NT version to ship in May, is a major event for multimedia producers. mFactory (415-548-0600) is pushing the envelope toward developing the premier multimedia application. With mFactory products, you don't create applications: You build 2-D worlds, populate them with objects that know how to behave, and institute world properties (such as gravity and collision detection).

We examined the initial release of mTropolis on a PowerMac. In one demo, a fish swims back and forth in its tank. We were able to grab the fish and pull it out of the tank, at which point it began to gasp and its eyes bulged. When we released it, the fish fell back into the tank and returned to its swimming. Such sophisticated behavior would normally take a huge effort, even in the high-end authoring environments we reviewed, but in mTropolis, it's just another day's work.

How, you may ask? mFactory has created a tool that really exploits the strengths of object orientation. The fish in the example above is an animation object produced in mFactory's cell-based animation module, mToon. mFactory places the mToon fish on a path with cell ranges tied to parts of the path, and collision detection begins to activate when the fish object encounters the tank wall object.



The MediaForge development environment supports nearly all authoring operations through drag-and-drop.

The object types supported today include text, audio, video, and animation. By the time mTropolis for Windows ships, there will be 3-D support using Microsoft's Reality Lab, very sophisticated text searching, hyperlinking, formatting, and the ability to create applications in which multiple users across the Web share a common world.

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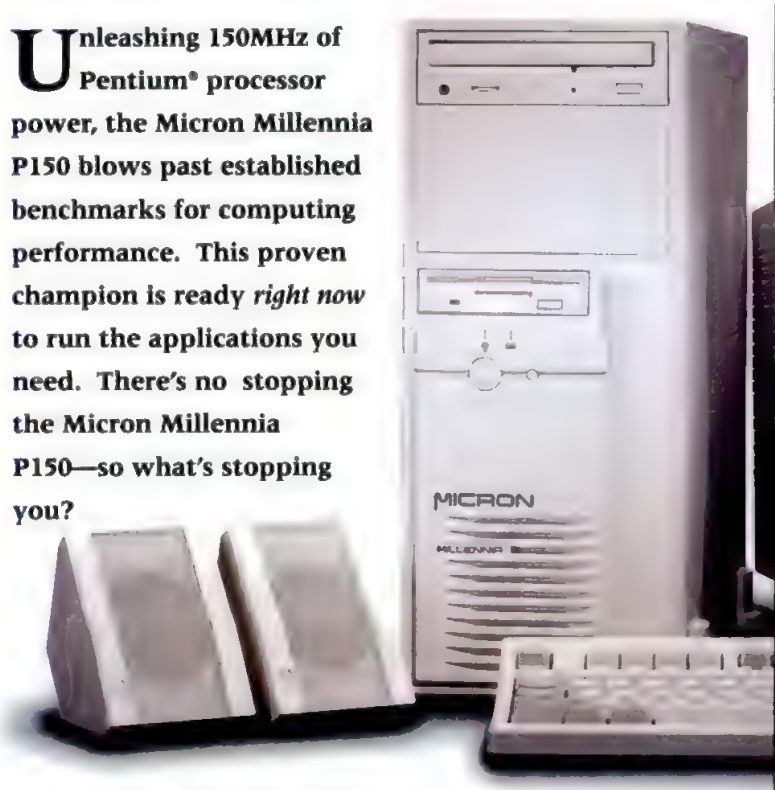

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- Microsoft Windows 95 CD & Microsoft Plus 95
- Microsoft Office 95 & Bookshelf 95 CDs
- **Microsoft Home Pak includes:** Works 4.0 for Windows 95; Publisher Deluxe for Windows 95; Encarta 96; Encarta 96 World Atlas; Music Central 96; Wine Guide; Arcade 1.0; Scenes–Sports Extremes Collection; Cinemania 96; Julia Child Home Cooking; Best of Windows Entertainment Pack; Money 4.0 for Windows 95; Holiday CD Sampler.
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OPTIONS

MULTIMEDIA OPTIONS

- Creative Labs SoundBlaster™ 32 Wavetable sound card* $59
- Creative Labs SoundBlaster 32 Wavetable sound card w/1MB RAM* $99
- Microsoft® Sidewinder Pro joystick $69
- Advent AV270 Powered Partners stereo speakers $99
- Advent AV370 Powered Partners w/subwoofer stereo speakers $199

NETWORKING OPTIONS

- NE2000 Compatible Ethernet ISA NIC (BNC & RJ-45) $49
- 3COM 3C509 Ethernet ISA NIC (BNC, AUI & RJ-45) $99
- 3COM 3C595 Fast Etherlink PCI 10/100 NIC (RJ-45 only) $159
- SMC ISA TokenCard network card $199

STORAGE/MEDIA OPTIONS

- Plextor SixPlex 6X 900kb/s SCSI** internal CD-ROM drive $200
  (upgrade from systems with standard 6X EIDE CD-ROM drive)
- Iomega SCSI** Jaz drive with 1.0GB removable cartridge $399
- Iomega Zip IDE drive with 100MB removable cartridge $99
- Iomega Ditto 800 (400/800MB) Travan Tape back up w/tape $149
- Iomega Ditto 3200 (1.6/3.2GB) Travan Tape back up w/tape $299
- Conner 4/8GB DDS-2 DAT SCSI** Tape back up w/tape $999

DISPLAY/VIDEO OPTIONS

- 17" Hitachi SuperScan 1711 (15.9" display) .26dp color monitor*** $300
- 21" Hitachi SuperScan 2111 (20" display) .22dp color monitor*** $1200
- Diamond Stealth64 video card w/2MB VRAM† $150
- Diamond Stealth64 video card w/4MB VRAM† $300
- #9 Imagine 128 video card w/4MB VRAM† $400
- #9 Imagine 128 video card w/8MB VRAM† $650

COMMUNICATION OPTIONS

- 28.8bd V.34 internal data/fax modem†† $149
- 28.8bd V.34 internal Telephony data/fax modem w/full duplex speakerphone and voicemail $159

OTHER OPTIONS

- APC Per7T surge suppressor $39
- APC Pro7T surge suppressor $69
- Microsoft Natural keyboard $79
- Microsoft Home Pak includes: Works 4.0 for Windows 95; Publisher Deluxe for Windows 95; Encarta® 96; Encarta 96 World Atlas; Music Central™ 96; Wine Guide; Arcade 1.0; Scenes–Sports Extremes Collection; Cenemania® 96; Julia Child Home Cooking; Best of Windows Entertainment Pack; Money 4.0 for Windows 95; CD Sampler (including Fury³ game demo) $149

*Upgrade from systems with standard SoundBlaster 16 sound card
**Requires SCSI Host Adapter
***Upgrade from systems with standard Micron 17" 17FGx color monitor
†Upgrade from systems with standard 64-bit 2MB EDO video card
††V.34 modems includes trial memberships to Compuserve™, Prodigy™ and America Online™

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MICRON ELECTRONICS, INC.

CIRCLE 370 ON READER SERVICE CARD

from the Toolset onto that screen provides the basis for your first screen. The Layout object, visible as an icon on the IconScript, also occupies the Attributes window, in which you can choose a background color or bitmap, select a screen size, and specify up to 34 more properties.

Next you can drag interface and media object icons onto the screen: list and combo boxes, edit boxes, text displays, bitmap placeholders, sliders and gauges, buttons of all types, video and audio, OLE, and animation. You can move these objects around, visually resize them, and set their properties by clicking on them in either the VisualScreen or the IconScript; doing so selects an object and opens it in the Attributes window. And you can leave the placeholder objects empty or specify their contents immediately.

Everest's object orientation, which supports object instancing but not subclassing, increases developers' productivity. For example, as part of the PC Labs test application, we dragged a button object, dropped it in the VisualScreen, and sized it for use as a Back control button to return to previous screens. In the Attributes window we named it, set the bitmaps used for *pressed* and *released*, and assigned it an "event code"—in this case, 33—that it would generate when pressed. And we did all this simply with drag-and-drop, point-and-click, and fill-in-the-blank.

NEARING THE PEAK

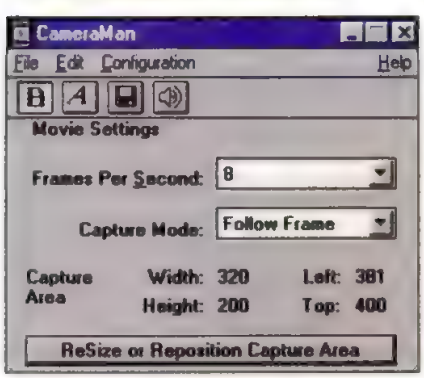
Then came the fun part. In the Attributes window, we set Save as Object to *true*. On the next screen, we dragged in another button off the Toolset. With one simple choice off a pull-down menu in the Attributes window, we made this new button an instance of the Back button that we saved as object, and the newly created button inherited all its properties.

Once your screen design satisfies you, Everest has provided an easy method of

The Demonstrators

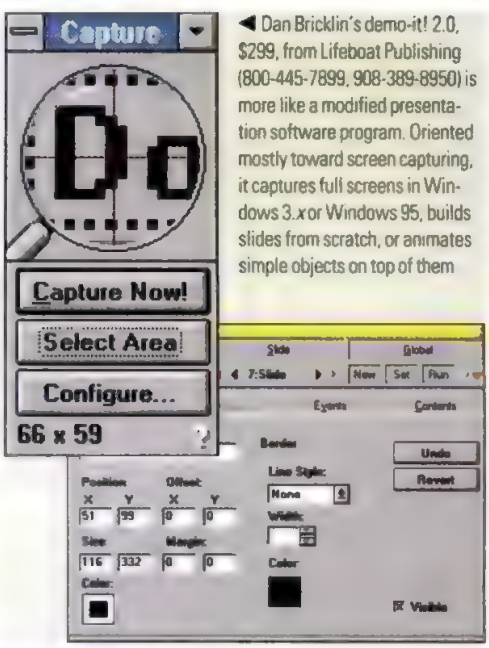
By Lance Ulanoff

What if you're reading these reviews and thinking, "But all I really wanted to do was create a simple software demo or tutorial?" Good news: A small collection of relatively simple products do just that. In addition to their obvious commercial uses, these products are particularly useful when demonstrating a corporate application or teaching an extended sales force how to use a package in a specific way.

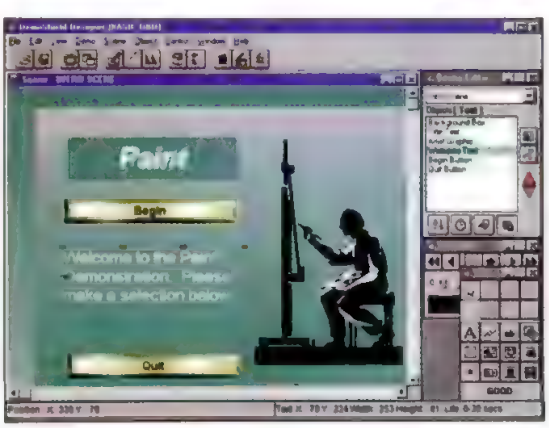


▲ CameraMan, Version 2.0.4, $69, from Motion Works Groups (415-541-9333), is a Windows 3.1 application that, with some subtle coaxing, will work under Windows 95—although when you first run the application, it doesn't appear on the screen until you use Windows 95's Cascade Windows command. Unlike Lotus's ScreenCam, CameraMan actually creates a frame-based animation file as it captures screen activity (at about 8 frames per second). Playback is smooth as long as you stick to the default 320-by-240 capture and playback window. This capture window follows your mouse around with a 320-by-240 pixel frame.

▲ Lotus ScreenCam, Version 2.1, $99, from Lotus Development Corp. (800-343-5414, 617-557-8500), may be the best known and easiest to use of all. A small interface allows you to record all on-screen activity and record a voice-over, either at the same time or later. You can also use ScreenCam's new captioning feature to reduce the file size. Though the product can record in up to 256-color mode, Lotus recommends 16 colors for optimal performance. Lotus ScreenCam can record Windows 95 sessions; it can play back Windows 3.1 demos on the newer platform.



◀ Dan Bricklin's demo-it! 2.0, $299, from Lifeboat Publishing (800-445-7899, 908-389-8950) is more like a modified presentation software program. Oriented mostly toward screen capturing, it captures full screens in Windows 3.x or Windows 95, builds slides from scratch, or animates simple objects on top of them



◀ DemoShield 4 for Windows, $495, comes from InstallShield Corp. (800-250-2191, 847-240-9111), makers of the popular InstallShield (which, you may notice, appears when you load the company's new software). Designed specifically to create new product demonstrations, DemoShield 4 is the most powerful of the four demo products examined here. It lets you choose between using frame-based capture and the bundled Lotus ScreenCam. DemoShield also includes a time-line editor and supports user interactivity—a real plus if you're creating tutorials.

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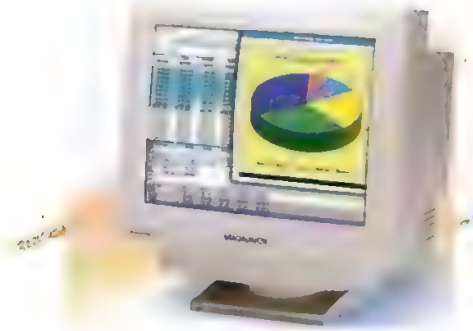

Works overtime. Very dependable. Backed by a 3-year warranty*, you can rely on the 17" Magnavox CM4018 (16.22" viewable image size) color monitor around the clock for everything from video conferences to business reports.

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CIRCLE 006 ON READER SERVICE CARD

SUMMARY OF FEATURES

Multimedia Authoring Tools

■ YES ▨ NO

Products listed in alphabetical order	Authorware 3	Everest Authoring System 1.5	IconAuthor 7.0 (PC MAGAZINE EDITORS' CHOICE)	ImageQ 2.31	Macromedia Director 4.04 (PC MAGAZINE EDITORS' CHOICE)	MediaVerse 1.5	Multimedia ToolBook 4.0: CBT Edition
Price	$4,995 (list)	$4,395; subscription, $239 per month (list)	$4,995 (list)	$749 (list)	$1,195 (list)	$799 (list)	$1,299 (street)
Platforms	Macintosh, Windows 3.1	Windows 3.1	OS/2, Windows 3.1	Windows 3.1	Macintosh, Windows 3.1	Windows 3.1, Windows 95	Windows 3.1
General Features							
User can distribute unlimited runtime version free	■	▨	■	■	■	■	■
On-site training	▨	▨	▨	▨	▨	▨	▨
Accepts DLLs	■	■	■	■	■	■	■
DDE send and receive	▨	■	■	▨	▨	▨	■
OLE 2.0 client/server support	■ ■	▨ ▨	■ ■	▨ ▨	▨ ▨	▨ ▨	▨ ▨
Supports MCI calls	■	■	■	■	■	■	■
Developer Interface							
Icon flowcharts	■	■	■	▨	▨	▨	▨
Outliner	▨	▨	▨	▨	■	▨	■
Text-based	N/A	N/A	N/A	N/A	▨	N/A	■
Nested flowcharts	■	▨	■	▨	▨	▨	▨
Multiple documents open	▨	▨	■	■	▨	▨	▨
Zoom views	▨	▨	■	■	■	▨	■
Ribbon bar or toolbox	■	■	■	■	■	■	■
Debugging utility	■	■	■	▨	■	■	■
User can set security privileges	▨	▨	■	▨	■	■	■
Hide menu bars and title bars	■	■	■	■	■	▨	■
Help Wizards	▨	▨	▨	▨	▨	▨	■
Programming							
Scripting language	▨	■	▨	■	■	■	■
Data type variables:							
Array	■	■	■	▨	■	▨	■
Integer	■	▨	■	■	▨	■	■
String	■	■	■	■	▨	■	■
Data validation	▨	■	■	▨	▨	▨	■
Paradigms:							
Object-oriented	▨	■	■	▨	▨	▨	■
Parameter-based	▨	■	■	■	■	■	■
Procedural (scripting)	▨	■	▨	■	■	■	■
Template	■	▨	■	■	▨	■	■
Scoring	■	■	■	■	■	■	■
Timing	■	■	■	■	■	■	■
User-Interface Objects							
Alphanumeric entry	■	■	■	■	■	■	■
Check boxes	■	■	■	▨	■	■	■
Dialog boxes	■	■	■	■	■	■	■
Drag-and-drop	■	■	■	■	■	▨	■
Palettes	■	▨	■	▨	■	■	■
Pull-down menus	■	■	■	■	■	▨	■
Push/radio buttons	■ ■	■ ■	■ ■	■ ▨	■ ■	■ ■	■ ■
Navigation							
Dynamic hyperlinks	■	■	▨	▨	■	■	■
Forward/backward navigation	■	■	▨	■	■	■	■
GOTO commands	■	■	▨	■	■	■	■
Jumps to start or finish	■	■	▨	■	■	■	■
Video							
Drives VCR/laserdisk player	■	■	■	■	■	■	■
Runs cropped and full-screen video	■	■	■	■	■	■	■
Supports chroma-keyed overlays	■	■	■	▨	■	■	■

N/A—Not applicable: The product does not have this feature.

Continues

	Oracle Media Objects 1.0.5	Quest 5.1
	$99 until May 31, 1996; $495 thereafter (list)	$3,995 (list)
	Macintosh, Windows 3.1	Windows 3.1
	■	■
	■	■
	■	■
	■	■
	■■	■■
	■	■
	■	■
	■	■
	N/A	N/A
	■	■
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Everest Authoring System 1.5

List price: $4,395 (or $238 per month for a subscription). **Requires:** 386/25-based PC or better, 4MB RAM, 8MB hard disk space, Microsoft Windows 3.1 or later, VGA card. **In short:** Everest is an easy-to-use tool that needs little or no traditional programming to create sophisticated CBT and kiosk applications.
Intersystem Concepts Inc., Columbia, MD; 410-531-9000; fax, 301-854-9428. *Circle 462 on reader service card.*

SUITABILITY TO TASK

	Power	Ease
Interactive title development	Good	Good
Computer-based training (CBT)	Excellent	Excellent
Interactive catalogs/kiosks	Fair	Good
Web authoring	N/A	N/A

N/A—Not applicable: The product does not have this feature.

scripting navigation and control flow. Drag a Wait icon (the center of control for each Everest screen) from the toolbar and drop it into the VisualScreen. Consider the opening menu of the PC Labs test application. Event codes of 33, 34, -101, -102, -103, and -104 were assigned to the buttons for Back, Main Menu, Forward, Tell Me More, Test My Knowledge, and Let Me Buy, respectively. Using the Attributes window, we entered actions for each of these event codes; for example, we associated the action BRANCH @prev—a function that transfers program control to the previous screen—with the 33-event code that the Back button generated.

To implement drag-and-drop for the matching quiz, we had to drag a program icon to the IconFlow and open an edit window, in which we entered A-pex–language statements. An excellent debugger supports this straightforward scripting, and a Variables window acts like a microscope into an executing application.

We did find a bug, however. We could drag and drop a picture object without any problem, but when we tried to drag a button object, the system refused to identify it. A call to tech support confirmed the bug. The next day we received a patch disk from Intersystem Concepts, and soon we were dragging and dropping buttons with aplomb. This unusual tech support greatly benefits the professional developer.

Overall, Everest offers a charming environment in which to create CBT applications. Additional modules from third-party vendors can infuse Everest with data-handling facilities to access databases and utilize rich text format. (The base product can access only its proprietary database, which can read to and write text files.) The technical support of Intersystem Concepts ranks with the best, and the hands-on tutorial builds confidence quickly, although the adequate documentation could use more depth and better indexing. For single-platform applications, though, Everest should definitely make your list.—*L&EVS*

AimTech Corp.

IconAuthor

PC MAGAZINE EDITORS' CHOICE

We last reviewed AimTech's IconAuthor in 1994. At first glance, it appears that two years have not substantially changed the program's core features—or its core philosophy. Version 7.0 of IconAuthor, priced at $4,995, still requires you to build your applications using an icon-based flowchart. It still maintains a strict separation between an application's structure and the actual content and still ships with a number of ancillary programs that help you edit and manage content.

But closer inspection reveals that AimTech has made several important

IconAuthor's SmartObject Editor allows you to control an object's behavior by assigning functional properties to it.

SUMMARY OF FEATURES

Multimedia Authoring

■ YES □ NO
Products listed in alphabetical order

	Authorware 3	Everest Authoring System 1.5	PC MAGAZINE EDITORS' CHOICE IconAuthor 7.0	ImageQ 2.31	PC MAGAZINE EDITORS' CHOICE Macromedia Director 4.04	MediaVerse 1.5	Multimedia ToolBook 4.0: CBT Edition
Internet Tools							
File exports: .GIF/JPEG/HTML	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Web server support	■	□	■	■	■	■	■
Data Files							
ASCII	■	■	■	■	■	■	■
dBASE	■	■	■	■	■	■	■
proprietary	■	■	■	■	■	■	■
ODBC support	■	■	■	■	■	■	■
Graphics							
Gradient color	■	■	■	■	■	■	■
Color-palette management	■	■	■	■	■	■	■
Transition effects	■	■	■	■	■	■	■
Animation:							
Path-based	■	■	■	■	■	■	■
Sequencing	■	■	■	■	■	■	■
Simple cell animation	■	■	■	■	■	■	■
Time lines	■	■	■	■	■	■	■
Tweening	■	■	■	■	■	■	■
Video file formats: .AVI/MPEG/QuickTime	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Text							
Adds drop shadows	■	■	■	■	■	■	■
Bevels text	■	■	■	■	■	■	■
Extrudes text	■	■	■	■	■	■	■
Fits text to curve	■	■	■	■	■	■	■
Rotates and sweeps text	■	■	■	■	■	■	■
Sound							
Can loop sound	■	■	■	■	■	■	■
Can kill sound	■	■	■	■	■	■	■
File Importing							
Animation: .FLC/.FLI	■■	■■	■■	■■	■■	■■	■■
Graphics:							
.BMP/EPS	■■	■■	■■	■■	■■	■■	■■
.GIF/.PCX	■■	■■	■■	■■	■■	■■	■■
Pict/.RLE	■■	■■	■■	■■	■■	■■	■■
Targa/TIFF	■■	■■	■■	■■	■■	■■	■■
.WMF	■	■	■	■	■	■	■
Sound:							
CD audio	■	■	■	■	■	■	■
MIDI	■	■	■	■	■	■	■
.SND	■	■	■	■	■	■	■
.WAV	■	■	■	■	■	■	■

changes to IconAuthor. Chief among them is the role of SmartObject Editor, which has become central to the creation of IconAuthor applications since its debut two years ago. SmartObject Editor assembles individual objects—such as imported pictures, sound files, video clips, animations, database links, text, push buttons, tables, and list boxes—into coherent page layouts. You control the appearance and behavior of these objects by changing the properties associated with each one. In PC Labs' sample application, for example, to create a drag-and-drop matching game, we just set the Draggable property of an imported picture to *true*.

IconAuthor handles multimedia objects with aplomb. Not only is it easy to import sound, movie, and animation files, but it also takes little effort to control them. For example, adding VCR start and stop buttons to a movie object requires just activating the Control Bar property in SmartObject Editor. And the ImageLab utility deserves special praise for its focused toolset, which preps graphics either on a file-by-file basis or in batch mode.

The one disappointing area concerns animation. Though IconAuthor handles well the straightforward process of running animation files in a stationary window, attempting jazzier effects—such as moving an animation window around the screen—proved unnecessarily difficult.

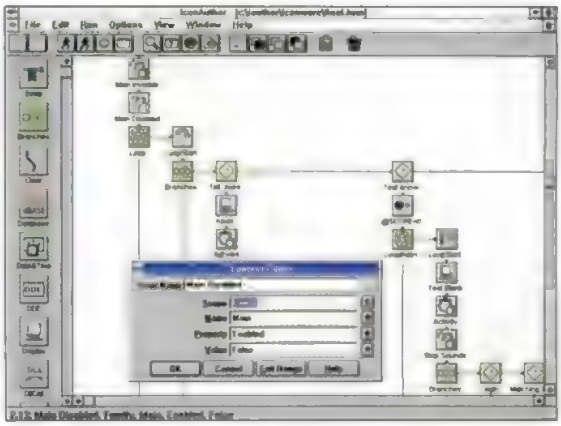
DATA CONTROL

Whether you are creating a CBT application or authoring a CD/kiosk presentation, you're going to have to import and manip-

ulate data. We were impressed with IconAuthor's ability to access databases via Microsoft Open Database Connectivity (ODBC) drivers. Once you establish a connection to a database externally (via the ODBC Administrator), you simply insert a database object into a SmartObject page. Though displayed in the working view as an icon, the database object itself is not visible at runtime. You retrieve specific information from the database using standard SQL statements and display the data by binding fields in the database to tables, text boxes, drop-down lists, check boxes, and radio buttons.

Difficulties may arise when you attempt to perform subsequent manipulations on imported data. Little glitches cropped up during testing. For example, though adding items from a database to an IconAuthor list box is fairly direct, deleting items from the list box requires complex icon structures that are likely to intimidate nonprogrammers.

Indeed, to get the most out of IconAuthor, it helps to think like a programmer. For example, nonprogrammers love having simple mechanisms (like GOTO commands) to structure applications. But in IconAuthor, you must use traditional branching and looping structures to create navigational paths in the flowchart.



Icons control the logic behind an IconAuthor application. To include a new function, you simply drag the appropriate icon from the ribbon bar (left) into the flowchart.

AN ALTERNATIVE

AimTech does market a lower-level product—the $1,495 CBT Express—that shields users from IconAuthor's complexities. Targeted for CBT development, CBT Express supplies ready-made templates to which you merely add content.

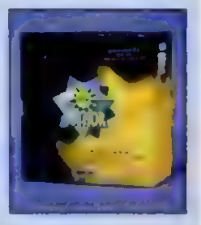
Developers looking for lots of distribution options and support tools will appreciate IconAuthor's capabilities. You can debug your applications using the IA Scope utility, which flags icons that cause errors. The Resource Manager allows you to collect files for distribution, compress files to conserve disk space, protect an application from changes, generate a setup program, and designate which files you want copied to your hard disk and which files will run from the delivery medium (such as a CD).

You can also develop applications for cross-platform playback. At press time, we could play back IconAuthor 7.0 applications on Windows 3.*x*, Windows 95, and OS/2; by the time you read this, you'll be able to play back on a Macintosh as well. AimTech also plans to ship a native 32-bit Windows 95 version of IconAuthor, as well as a Windows NT program, for creating applications.

Version 7.0 also addresses the needs of Web authors. The abilities to read (but not write) HTML code and to point toward a content file with a URL (Uniform Resource Locator) instead of a local path statement make it possible to run IconAuthor applications on the Internet. You can even set up IconAuthor Present (the runtime player) as a helper application in a Web browser, such as Netscape.

One of the granddaddies of multimedia authoring software on the PC, IconAuthor still has enough significant strengths—easy access to databases, smart evaluation of user input, and manipulation of variables on the fly—to qualify it as a more than capable contender among its mostly younger competition.—*Luisa Simone*

IconAuthor 7.0



List price: $4,995 **Requires:** 486/25-based PC or better, 8MB RAM, 13MB hard disk space, Microsoft Windows 3.1 or later, VGA card, 2X CD-ROM drive. **In short:** IconAuthor, a highly recommended development environment, includes a flexible flowchart metaphor that lets you build sophisticated CBT and multimedia applications without resorting to writing code. Data access and manipulation exceed that offered by the competition, and a host of useful utilities let you perform all of the ancillary functions necessary for the successful creation of an application.

AimTech Corp., Nashua, NH, 800-289-2884, 603-883-0220, fax, 603-883-5582, http://www.aimtech.com. *Circle 463 on reader service card*

SUITABILITY TO TASK

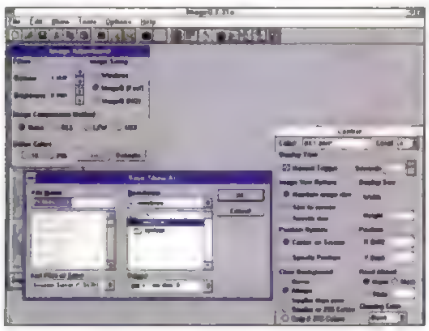
	Power	Ease
Interactive title development	Excellent	Excellent
Computer-based training (CBT)	Excellent	Good
Interactive catalogs/kiosks	Excellent	Good
Web authoring	Good	Excellent

Image North Technologies Inc.

ImageQ

In the multimedia world, some vendors misleadingly claim that they have developed *complete* multimedia authoring software packages. Image North Technologies' ImageQ 2.31 is a good example. Although ImageQ, a Windows 3.1 application that also plays back on Windows 95, creates slide show presentations well and provides a way to distribute them easily, it lacks the intuitive programming language and strong interface necessary for truly productive multimedia applications development.

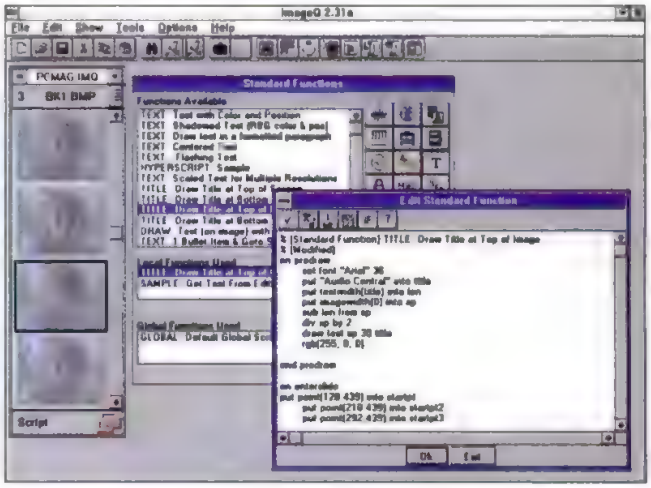
ImageQ presentations comprise a series of background images and associated control scripts that add user interface controls, overlay images, and underlying programming to each slide. ImageQ uses a multiple-document interface to manage one or more presentations simultaneously. The slide strip window for each presentation contains either thumbnails or file information for each slide image and provides the means of navigating through the presentation at design time. Although the images in the slide strip are miniature versions of the background images, they do not show any of the user interface elements you have added, such as buttons and list boxes. You must create these through code, which ImageQ will interpret only at runtime—a major deficiency that other authoring systems (such as IconAuthor and Director) avoid by offering design tools to arrange interface controls visually without code.



ImageQ provides several image enhancement and compression options; control features are similar to those of presentation packages.

While ImageQ does not provide the robust slide design tools that competing products include, it does import a wide variety of graphics formats. Once you have imported your images into an ImageQ presentation, you can keep them in their native formats or save them as .BMP or .HKF files.

.HKF files use Image North's proprietary 10:1 compression to reduce the size of 16-, 24-, and 32-bit images. When you import images into an ImageQ presentation, you're really only creating thumbnails and slide references; the images themselves remain as separate files. The list of filenames and the control and transition settings are stored in a file with an .IMQ extension, which serves as the main file for the presentation. A file with an .SLD extension stores your presentation's thumbnail images, and another file with an .NTS extension contains all control script code and slide notes.



ImageQ presentations center around a series of images contained in the slide strip window. You must add other controls or media through code only.

ALL IN CODE

ImageQ's programming language is awkward to work with, because it uses unconventional syntax and event handlers. The control script language abandons the standard +, -, *, and / operators for wordy alternatives like "add" and "div." For example, you can add two values in a single statement only with the syntax "add X to Y." Similarly, ImageQ uses lines like "put 150 into X" instead of the Equal sign for simple assignments. When you code in ImageQ, you can use the many prewritten code snippets—Image North's attempt to make ImageQ's code more productive and cleaner—available in the Standard Functions window.

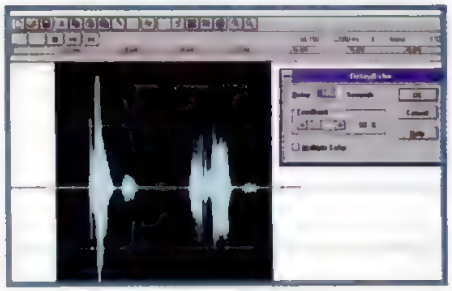
Unfortunately, this template-based approach can cause problems. Whenever you create a new button, overlay, or list box, you assign it a particular number. Since the snippets tend to use the same numbers, you often find yourself inadvertently breaking previous code while adding new functions. To complicate matters further, ImageQ's

Clip-Media Shortcuts *By Arie Moller*

Once you decide to populate your multimedia application with media, you can take one of two directions: the easy way or the hard way. If you go ahead and create all your content from scratch, you've gone down the rocky road. The most efficient approach is to use one of the following products, nearly all of which provide easily importable, prepackaged content. Whether it's images, sound, or video, any of these media collections can add pizzazz to your multimedia. And if you're looking to organize your clips, see the multimedia manager products that bring up the rear.

Sonic Waves 3000, from Innovative Media Corp.

This $99.99 two-CD-ROM set, from Innovative Media Corp. (217-544-4614), has over 1.2GB worth of 16-bit .WAV files, including such sounds as multiple-person applause and machine-gun fire. IMC's sound editor, Sound Forge Apprentice, lets you easily produce just the right sound effect.



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CIRCLE 179 ON READER SERVICE CARD

slide control script can contain numerous event handlers with the same name that respond to the same event. This makes locating bugs unnecessarily challenging.

ImageQ proved a frustrating companion as we built our test application. We found that adding a series of buttons and list boxes to a slide—a task that should be as simple as drawing them on the screen—took far too much time: We had to position each button through the coordinates of its own Draw command in the control script, which basically created a trial-and-error process. So we spent almost all of our applications development time coding details. The Standard Functions window attempts to ease the coding chore by using dialogs to set the positions, labels, and other details for the visual controls you add. However, you still have no way to see where controls relate to others created in the script. This approach also results in very lengthy code snippets with many variables, which makes control scripts rather difficult to decipher at a glance.

Though ImageQ lacks design and programming tools, it does well with distribution. You can build portable presentations as standalone .EXE files that include the ImageQ runtime. When you create a portable presentation you can use an HKF, LZW, or RLE compression scheme to reduce the size of the images. During our testing, ImageQ skillfully incorporated graphics files, sound, and video clips from various locations and allowed us to create a set of floppy disks for distribution. After we created the .EXE file, we used the Transfer command to put the presentation on disks. The program split the .EXE file across the disks and, when it detected that we used an .AVI file, asked if we wanted to include the Video for Windows runtime files. It also put an installation program on the first disk that took care of recombining the file and creating an icon on our target machine.

ImageQ is really a presentation package in an authoring system's clothing. Its real strength lies in its ability to create traditional slide shows with prebuilt images and distribute them with no royalty. Yet the product's lack of interactive design tools and its clumsy programming language ultimately make it a poor choice for robust multimedia applications development.—*Stephen W. Plain*

ImageQ 2.31

List price: $749 **Requires:** 386/33-based PC or better, 8MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or later, VGA card **In short:** ImageQ lends itself primarily to managing a series of images. Although the scripting language is not as sophisticated as that of other products, ImageQ does offer the ability to build self-contained executable versions of your applications

Image North Technologies Inc., Waterloo, Ontario, Canada, 800-363-3400, 519-570-9111; fax, 519-570-9140 *Circle 464 on reader service card*

SUITABILITY TO TASK

	Power	Ease
Interactive title development	Fair	Fair
Computer-based training (CBT)	Poor	Poor
Interactive catalogs/kiosks	Poor	Poor
Web authoring	N/A	N/A

N/A—Not applicable: The product does not have this feature.

Macromedia Inc.

Macromedia Director

PC MAGAZINE EDITORS' CHOICE

Macromedia's appropriately named Macromedia Director 4.04 seats you smack in the director's chair to create multimedia movies. While this novel approach provides considerable control, it is better suited to multimedia presentations and kiosk applications than CBT or interactive catalogs that require more database work.

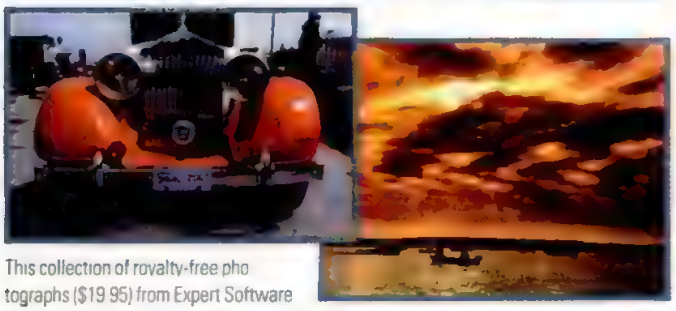
Even so, this $1,195 product offers a lot: a central scoring component that provides precise timing control, cross-platform compatibility, strong yet intuitive animation features, and an extensive architecture that lets you add functionality.

THE AUTEUR

Director's user interface hardly resembles that of its big brother, Authorware. The application is a *movie*, the playback screen is the *stage*, and the various elements in your movie are *cast members*. To direct the movie, you drag the cast members to the stage or into Score Window—the central blueprint of the movie—and then modify the individual cast member's behavior. A Director movie consists of frames that comprise many separate, individual channels, each of which can hold a *sprite* or sound, custom palette, and the like. Each sprite is an instance of a cast member, such as a piece of text, a bitmapped image, or a digital video clip.

Because you have access to all of the sprites during each frame of the movie, you have the ultimate time-based control. Of course, such a directional approach has

3000 Photo Gallery #2, from Expert Software



This collection of royalty-free photographs ($19.95) from Expert Software (800-759-2562, 305-567-9990) runs on both Windows- and Macintosh-based systems. The images, organized into 25 categories, range from animals to technology. You'll easily find the image you're looking for with Expert's ClickSearch keyword system, and you can export all images to your favorite multimedia program in .PCX, TIFF, or .WMF formats.

The Object Series, from PhotoDisc

To quote the catalog from PhotoDisc (800-528-3472, 206-441-9355), the Object Series ($149 per disk) gives you "entire categories of, well, things." The "things" range in subject from fruits and vegetables to retro relics. The search engine, licensed from Ulead Systems, lets you define a search not only by keyword but also by criteria such as file size and image date. PhotoDisc also markets the Signature series, a collection of photographic studies.

Has lived in New York all his life.
Never visited the Empire State Building.

drawbacks: The score metaphor doesn't lend itself very well to complex programmatic control, and creating complex applications that use conditional branching is awkward. And while you can jump between frames, you don't have the clear picture of your application's flow that exists in the flowchart-oriented Authorware.

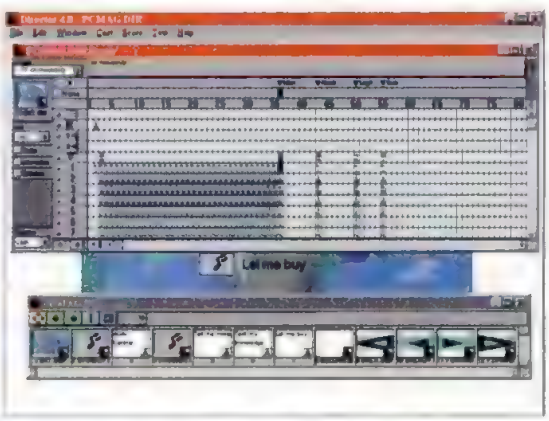
Director has 48 separate sprite channels available in each frame. Sprites are only copies of the cast members, so you can modify their look in a particular frame and not affect the original cast member. Each channel number represents a stage layer, so you can move the sprites between layers by simply shuffling them up and down. Some special channels exist to refer to each frame: transition, palette, tempo, script, and two sound channels.

One of Director's strongest features is its cross-platform compatibility. The Windows and Macintosh versions of the product are binary-compatible, so you can transfer Director movies between them by simply moving the file. This allows seamless collaboration with the large number of users who prefer the Macintosh for graphics tasks. Macromedia plans to extend Director's cross-compatibility even further, to set-top devices like 3DO.

CAST OF CHARACTERS

Director imports an impressively broad range of graphics formats. When you import a file, it automatically becomes a cast member and receives a number. Version 4.04 now has the ability to mix sound files sampled at different rates and sizes, but you can't mix .AIF and .WAV files *with* the audio in digital movie clips. Yet the program makes distribution easy, because you can export a Director movie or part of one to a Video for Windows .AVI file. Surprisingly, exported .AVI files cannot include audio.

Animation features, one of Director's strongest suits, let you set your sprites in motion differently. The product also includes a real-time recording feature that will memorize sprite movements while you drag moving sprites across the stage and translate them into a series of frames. Though this recording technique is the easiest way to create an animation, it produces jerky results at times.



Macromedia Director lets you import the various elements of your presentation as cast members.

Director lets the nonprogrammer arrange cast members frequently and put them in motion, but robust movies need some coding. Director's language, Lingo, uses English-like phrases for commands, but getting used to it takes some time. From Lingo, you can call up XObjects, Director's framework for extending the language's capabilities. Written in C, XObjects supplies access to text files; it constitutes Director's only built-in database support.

Director proved very useful for implementing linear presentations but weak for complex programming: We found creating conditional logic cumbersome and database access disappointing. We also discovered that as the score grew in size, we had difficulty navigating it. Still, the cast-member model and the precise frame-by-frame control pleased us overall.

Macromedia's Shockwave for Director, free from the company's Web site, has the ability to put Director movies directly with-

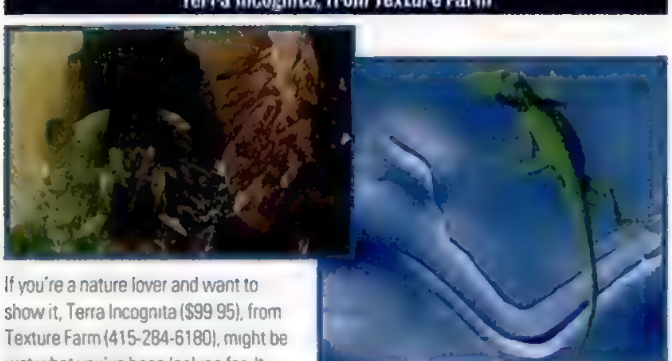
Macromedia Director 4.04

List price: $1,195
Requires: 486/33-based PC or better, 8MB RAM, 40MB hard disk space, Microsoft Windows 3.1 or later, VGA card, 2X CD-ROM drive
Macromedia Inc., San Francisco, CA, 800-756-9603, 415-252-2000; fax, 415-626-0554; http://www.macromedia.com **In short:** Macromedia Director excels at producing precisely timed linear presentations. Its Score Window and wise use of sprite copies of individual elements provide flexibility; its cross-platform compatibility allows unprecedented collaboration *Circle 465 on reader service card*

SUITABILITY TO TASK

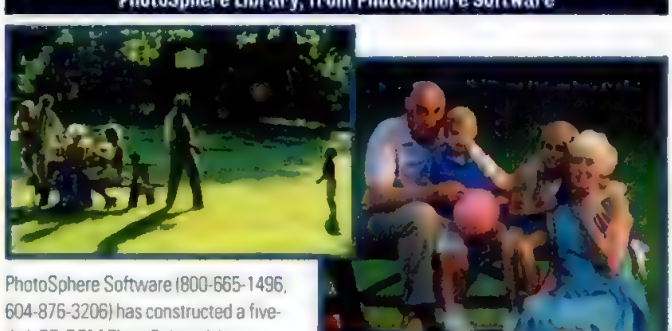
	Power	Ease
Interactive title development	Excellent	Excellent
Computer-based training (CBT)	Fair	Good
Interactive catalogs/kiosks	Good	Good
Web authoring	Good	Excellent

Terra Incognita, from Texture Farm



If you're a nature lover and want to show it, Terra Incognita ($99.95), from Texture Farm (415-284-6180), might be just what you've been looking for. It contains 100 digitally manipulated images of natural textures and abstracts, from abalone shells to rhino hide. You can display all the images in Photo CD or Pict format.

PhotoSphere Library, from PhotoSphere Software

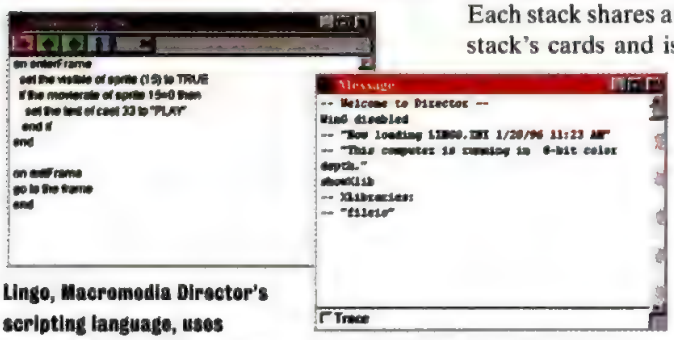


PhotoSphere Software (800-665-1496, 604-876-3206) has constructed a five-disk CD-ROM PhotoSphere Library ($250 per disk) that offers multiple perspectives of single-perspective images. Each object is photographed from various angles in both vertical and horizontal formats, and each disk contains 100 royalty-free images.

Was born and raised in Paris.
Has never been to the top of the Eiffel Tower.

in HTML Web pages. Shockwave consists of Netscape Navigator and the Afterburner movie processor, which converts your movies into compressed Shockwave-compatible versions that you can embed in HTML code. Shockwave movies may take a while to transfer before running, but they can produce impressive home pages.

At press time, Macromedia was working on Director 5.0, an upgrade that should include a new user interface, more import filters, robust text handling, and new players for various Internet browsers. Where Version 4.04 is a 16-bit application that plays back on Windows 95, Version 5.0 will be available as a native 32-bit version for Windows 95/NT.



Lingo, Macromedia Director's scripting language, uses English-like phrases for programming and lets you query variables.

Though Director can create complex multimedia events such as CBT, you still need a bit of programming expertise to pull them off. For time line–based interactive titles and demo CDs, however, Director is an exceptionally useful tool that exploits a logical metaphor to achieve spectacular results.—*SWP*

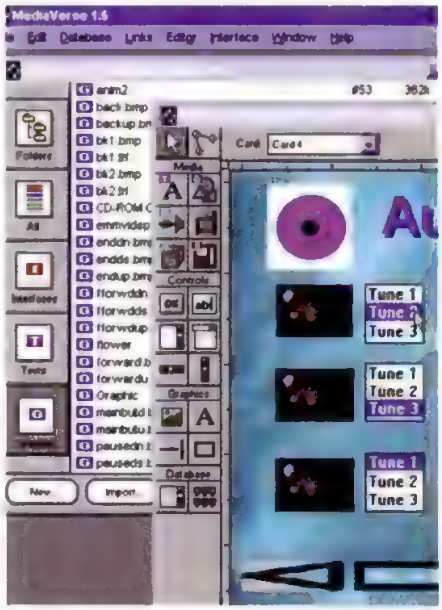
Looking Glass Software Inc.

MediaVerse

Neither a CBT tool nor a typical kiosk creation program, Looking Glass Software's $799 MediaVerse 1.5 takes its own road. Developers who must make sense of an existing media collection or producers who wish to turn a linear source (such as a book) into a nonlinear interactive title may find all they need in MediaVerse. But unfortunately, the product's novel approach comes with an immature development environment.

MediaVerse, a 16-bit application that runs on Windows 3.1 and Windows 95, follows the Hypercard concept: An application consists of one or more card stacks. Each stack shares a background with the stack's cards and is a screen of the application containing the user-selected and specified objects that present media and interface components. But this is where MediaVerse's similarity to other Hypercard-inspired tools—such as Multimedia ToolBook and Oracle Media Objects—ends.

When you open the development environment, an abundance of window opens up. The MediaVerse database, a repository of media with a tool to shift your view easily, dominates your display. You can view by media type or a folders perspective, and a flat view lets you peruse all media types. The database represents both files that you've imported into MediaVerse and linked files that remain external. MediaVerse marks every object accordingly.



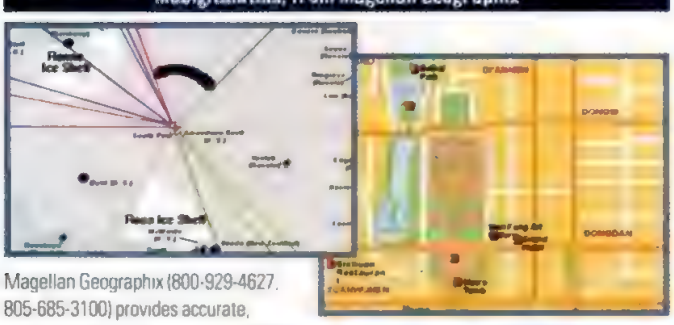
MediaVerse doesn't perform drag-and-drop; instead, list boxes match the composer with their tunes.

The edit mode lets you launch an editor for each media type by clicking a media object. Hypertext, the text editor's specialty, outshines the rudimentary graphics and .WAV editors. And the interface editor, in which you build your application, provides most desired features.

WELL VERSED

Media linking, perhaps MediaVerse's most powerful and distinctive feature, lets you place clickable areas called HotLinks into your media and link these hot spots to other media in the database. You create such links in Link mode; just point, drag, and drop. These useful MediaVerse editors can

MGDigitalAtlas, from Magellan Geographix



Magellan Geographix (800-929-4627, 805-685-3100) provides accurate, customizable digital maps for publication and presentation use. The MGDigitalAtlas library database contains over 1,000 digital maps. In addition to MGDigitalAtlas, Magellan Geographix markets MGDigitalEarth, a library of satellite maps. Prices for MGDigitalAtlas maps range from $25 to $400; for MGDigitalEarth maps, from $50 to $200.

DigiClips Special Edition, from Tri-Digital Software

DigiClips Special Edition ($24.95), from Tri-Digital Software (800-206-2547, 206-286-9402), takes the "a little bit of this, a little bit of that" approach to clip media. The CD offers 75 royalty-free Indeo video clips, 50 voice clips, 50 bitmapped photos, 25 music clips, and 10 animation clips. By the time you read this, a new addition to the DigiClips series, DigiClips 95, will be shipping.

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create HotLinks in .WAV files, .AVI videos, and graphics and text files.

The interface editor lets you create a simple screen with a media placeholder for each media type. Drag a media object, such as a graphic with HotLinks, into the placeholder. Click a HotLink and the linked object will come up in the appropriate placeholder. You can follow HotLinks from this media object to others.

PC Labs' testing did not include object management or the creation of interactive multimedia books, tasks for which MediaVerse seems best suited. To complete the tasks required by the testing script, we had to make a number of simplifications. We could not animate the main title of our application to slide into place, nor could we implement pick, drag, and drop for the CBT quiz. MediaVerse does not directly support CD audio and MIDI, which require MCI commands, and implementing the data access and file writing proved possible but cumbersome.

Further checking revealed nearly useless documentation and a general immaturity in MediaVerse's development environment: Huge dialog boxes have no cancel option; program-editing boxes have no editing facilities (as in cut-and-paste); the online help system often says things like "The script edit box is where you edit script"; and you lose references of media objects after you import one.

TOOLKIT

The interface editor features a tool palette of common interface objects such as buttons, list boxes, and placeholders for media. Select an object type from the toolbar and place it on the card, sizing it via point-and-drag. Double-clicking on the object brings up a properties dialog that specifies the values of attributes. You can add your own attributes, set their data types, and initialize them. But make sure to save often: The attributes box has no cancel button to undo the changes you've made.

MediaVerse scripts object behaviors by connecting outputs (O) with inputs (I). Here we see a script activated by clicking the Total button, summing it, and linking the items.

Once you've chosen, placed, and specified your objects, you must next assign behavior to the interface. Again, MediaVerse follows its own path with a method not quite fully developed yet likable nonetheless. We could create a screen that let us play sound files and match them with the correct image of the composer. To play each file, we created a button by clicking the button object on the toolbar. We sized and labeled it, then dragged the icon of a .WAV file onto the card containing the button. But the visual representations of the button and sound object became grayed when we switched from Edit to Link mode.

Unfortunately, no definitive identifier links the input/output icon from an object in Link mode to the object you see in Edit mode. MediaVerse attempts to locate the

MediaVerse 1.5

List price: $799 **Requires:** 486/66-based PC or better, 8MB RAM, 4MB hard disk space, Microsoft Windows 3.1 or later, VGA card, 2X CD-ROM drive **In short:** MediaVerse is an average hypermedia authoring tool optimized for creating interactive books and media management but adaptable to kiosk creation and CBT **Looking Glass Software Inc.**, Inglewood, CA, 310-348-8240, fax, 310-348-9786 *Circle 466 on reader service card*

SUITABILITY TO TASK

	Power	Ease
Interactive title development	Fair	Good
Computer-based training (CBT)	Fair	Fair
Interactive catalogs/kiosks	Good	Good
Web authoring	N/A	N/A

N/A—Not applicable The product does not have this feature

KPT Power Photos I and II, from MetaTools

In their approach to digital imagery, the folks at MetaTools (805-566-6200), formally HSC Software, have emphasized quality rather than quantity. KPT Power Photos I ($199) contains 500 images, and Power Photos II ($199) follows with 375 more. Both volumes have been color-corrected and contain built-in channels for easy layering of objects. As we went to press, MetaTools shipped the third in the Power Photos series, a five-disk CD-ROM set with 375 images.

The Publishers Depot

For a amazing collection of multimedia-based clip media, point your World Wide Web browser to *http://www.publishersdepot.com*. The Publishers Depot (800-764-7427, 703-312-6210), through licensing agreements with some 50 clip-media providers, offers more than 350,000 images and sounds for direct sale.

Even greater expansion is in the works, too: By the time you read this, Publishers Depot will be providing online video footage as well. Typical licensing fees cost at least $30 for a 300K image file.

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pilot
The one touch organizer

*The average U.S. street price for PILOT complete with all desktop and organizer software, docking cradle and accessories. © 1996 U.S. Robotics Inc. U.S. Robotics and the U.S. Robotics logo are registered trademarks and PILOT is a trademark of U.S. Robotics, Inc. and its subsidiaries. All other product names are registered trademarks or trademarks of their respective owners.

U.S. Robotics

input/output icon "over" the grayed-out object, but so many objects on a screen can be confusing. Clicking on the *O* of the button's input/output icon produces a dialog box of attributes, events, relationships, HotLinks, and wires. We selected the Clicked event and connected it to the play method of the sound object. A wire appeared that connected the output of the button to the input of the sound, which provided visual confirmation.

Looking Glass promises that Version 2 of MediaVerse will include a more mature environment, extensions to support data access, and even deployment over the Internet. If the applications you develop fall precisely within MediaVerse's territory, the product, despite its shortcomings, should fulfill your needs. In any event, MediaVerse, with its unique approach, is certainly a product to watch.—*L&EVS*

Asymetrix

Multimedia ToolBook: CBT Edition

Billed as "the world's easiest visual authoring system," Asymetrix Corp.'s Multimedia ToolBook 4.0: CBT Edition ($1,299 list) might be better described as a visual *programming* authoring system, for the product's true strength lies in its programming language, OpenScript.

A major upgrade, Multimedia ToolBook 4.0 lets users add Visual Basic controls to their applications, share scripts among objects (which saves valuable editing time), and choose from more than 40 new OpenScript keywords and DLL functions. ToolBook, a Windows 3.1 application, now also plays back on Windows 95.

The right-button menu for each object in Multimedia ToolBook allows users to access associated scripts and attributes quickly.

Because a script lies behind every object that you pull together to assemble your application, ToolBook may seem more code-centric than some of the other products reviewed here. However, if you want to create basic multimedia applications without database access, you really needn't touch the code.

The CBT edition is not just an add-on but is best described as a superset of the regular Multimedia ToolBook ($749). Readers should note that because of the CBT items specified in our PC Labs' testing script, we elected to test the more feature-filled CBT edition rather than Asymetrix's basic multimedia authoring software package, Multimedia ToolBook. The two products, while both 4.0 releases, differ substantially, especially in price. Though the CBT edition costs almost twice as much as the regular version, its extras (such as additional CBT prescripted objects called "widgets") and layouts save time when you author. The CBT edition also offers more than 100 additional CBT-related OpenScript functions and more options for bookmarking and scoring. Bookmarking enables the application to keep track of what pages the end user has visited.

The Course Management System also comes with the CBT edition. It consists of both administrative and student applications. The administrative application allows you to determine access, create a course consisting of books, and review student activity. The student application allows students to take assigned courses, review personal transcripts, and change their own passwords.

Despite all this CBT expertise, Asymetrix representatives admitted that you still need an add-on—such as their $195 Database Connection, which will be shipping by the time you read this—to perform database tasks easily.

THE TOOLBOOK EXPERIENCE

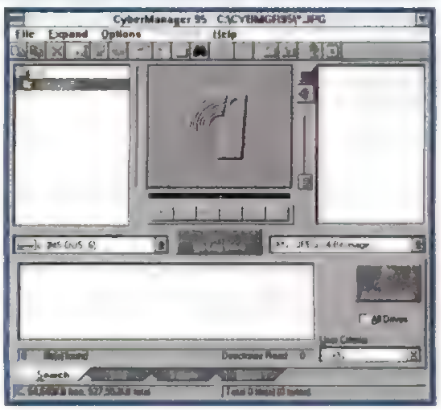
In ToolBook, an application is a "book" comprised of "pages." This book meta-

CD-ROM Transportation Set, from Four Palms

The five-disk CD-ROM Transportation Set ($99 per disk, $399 for the complete set), from Four Palms (800-747-2567, 703-834-0200), contains extensive video clips (airplanes flying, boats gliding, trains chugging). Each CD-ROM in the set contains over 80 Indeo video sequences which you can play in either a window. And you can search for just the right clip through keyword searches or thumbnail previews.

CyberManager 95, from Cyber Interactive

Cyber Interactive (800-692-9237, 206-869-1414) wants to help you organize the mess of clip media that clutters up your machine. The company's multimedia manager, CyberManager 95 ($69.95), can handle 23 media formats ranging from .BMP files to Autodesk, .FLC, and .FLI files. Special features include on-screen volume control, full-screen video playback, and on-the-fly directory creation.



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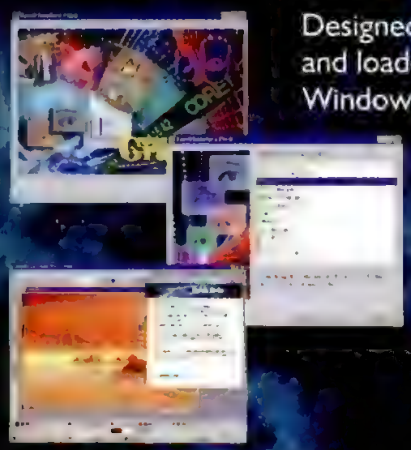

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Authoring Multimedia with Visual Basic

By Dan Smith

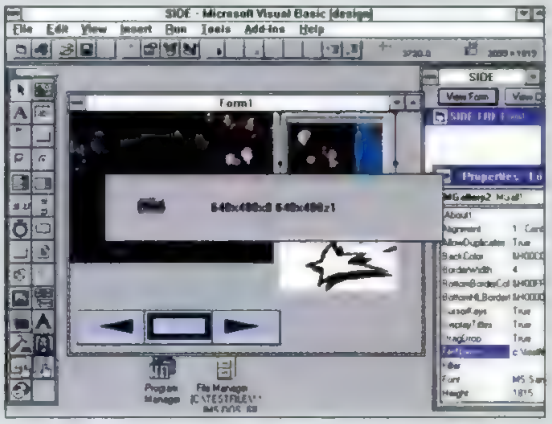
Supposedly you can build anything with the programming tool, Microsoft Visual Basic (VB), even multimedia applications—and VB does include some multimedia controls. The capabilities of these controls, however, are pretty basic and rather limited. Ultimately, those bent on making VB their authoring environment will probably need one of two tools to help them along: Lenel System's Lenel Gallery VBX or Motion Works' MediaShop. These are two 16-bit VB controls that extend the multimedia capabilities of VB.

The combination of VB and **MediaShop**, $299.95 from Motion Works Groups (415-541-9333), offers developers and programmers a rich set of tools to create high-quality multimedia titles, kiosks, and presentations without the steep learning curve that accompanies the more expensive multimedia authoring packages. MediaShop comes bundled with five multimedia VBX (Visual Basic Extension) controls, as well as four standalone interactive multimedia editors.

MediaShop's multimedia VBX controls let users create and integrate media with VB by providing links between the authoring environment (VB) and MediaShop's standalone multimedia editors. Lenel Gallery VBX lets developers integrate thumbnail galleries and multimedia features directly into VB.

To help you get started, MediaShop provides an interactive picture tool. This bitmap editor is used to create named hot-spot objects on a single bitmapped image. You can manipulate these hot-spot objects in VB using interactive picture control through code. MediaShop supports .BMP, .DIB, and .RLE bitmap extensions. The interactive picture control also gives users a real-time view of their bitmaps on the VB form.

With the interactive video tool's object editor, you can create video hot-spot objects, which can be any rectangular area in the video frame. You can then save them as an Audio Visual Interleaved (.IVD) file, MediaShop's proprietary file extension, for use later in the VB application. Beware, though: No Video start, stop, or play controls exist. These features are available only through code, because the video control tool is a standalone application that is not integrated into VB.



With Lenel Gallery VBX and MediaShop, you get a real-time view of video and bitmaps.

The Interactive Animation Tool allows users to create, edit, and maneuver objects within an animation. With the paint component, you can create animated actors (foreground objects) and props (background objects), and superimpose two drawings. Components for motion include the cel sequencer (which coordinates the actors cels with the frames in the animation), a media controller for playing animations, and a time-line window to view all of the objects and animation frames. Finally, the sound component provides a wave editor to modify sounds.

If you want to manipulate an animation in VB, you must load the interactive animation control with the AnimFileName property set to the path and animation filename. With the sound annotation tool editor, you can use text and digitized speech to create spoken text. Other features include the ability to group words to produce a sentence and a sound annotation test dialog that allows users to test individual words and phrases. Finally, the picture button control lets users include bitmaps as buttons, which users typically use to simulate a push button's up and down states.

On the downside, MediaShop lacks integration between VB and the interactive tools. To create hot spots, animation, video, and sound, users must leave VB and load each interactive tool separately. Although this may tire and frustrate users, it should not discourage anyone from using MediaShop for high-quality multimedia applications.

A LITTLE LESS POWER

Lenel Gallery VBX, $99 from Lenel Systems International (800-225-3635, 716-248-9720), is really a single custom control for VB that allows users to view a variety of bitmap graphics including JPEG, Photo CD, and icons inside a VB application. Gallery VBX supports drag-and-drop, so users can simply grab the files they need and drop them into the application, but you do need a control frame for each object that you drop. In addition, Lenel offers two other multimedia development tools sold individually, MCI Drivers Kit ($199) and MediaDeveloper VBX ($299).

Both MediaShop and Lenel Gallery VBX provide users with extensive multimedia control of their VB applications. MediaShop's wide range of features, however, rivals the ones found in more expensive multimedia authoring packages. If you know Visual Basic and want to create multimedia applications in that environment, you will want to take a good look at these two tools.

phor doesn't offer a bird's-eye view or an icon-based flowchart of the pages and their links—a serious drawback for users who plan to construct a large application with complex links. And though you can access everything from the basic ToolBook page display window, ToolBook's graphics features include only lines, ellipses, polygons, and line ends—unlike IconAuthor, which offers more extensive graphics features. Fortunately, a sufficient and well-thought-out interface with floating palettes lets you access features easily.

In object-oriented ToolBook, each item—from the smallest graphic or button to the background, page, or overall book—is a discreet object with its own properties. You can select or modify these properties through context-sensitive object properties dialog boxes, OpenScript, or the right-mouse-button pop-up menu. In ToolBook's programming-based environment, objects also have such values as *true, false, red,* and the like.

ToolBook has the usual tools for creating runtime versions, as well as locating and packaging multimedia components, and its manual offers suggestions for optimizing titles. ToolBook helps you automate programming tasks in a variety of ways: through the New Book Specialist, AutoScripts, or widgets. All anticipate the most common multimedia actions and needs. The New Book Specialist queries the user about layout, defaults, and page size, then sets book and page properties and creates a template book.

Once you create objects, you can either write OpenScript scripts to determine their function and behavior or work in AutoScript. The AutoScript icon allows you to create a script by selecting an action item from column A and a result item from column B. For example, you can marry an action, say a mouse button click, to a list of defined results, such as "play a video clip."

Widgets, selected from the widget catalog, are more elaborate, prescripted items such as "video widgets," which contain video display areas with predrawn and prescripted playback controls. ToolBook also includes widgets for 3-D buttons, Bookmarks, Elapsed Time Indicators, and Questions and Responses.

Multimedia ToolBook: CBT Edition's catalog of widgets offers a large number of predrawn, prescripted commonly used objects.

ToolBook's object/properties method offers a consistent approach across all elements. But you can access information only on an object-by-object basis, since ToolBook doesn't use the icon flowchart that products such as Authorware have. The Object and Properties lists, however, help you keep track of the scripts, properties, and values for a large number of elements.

ToolBook scores some solid points. For example, it pieces elements together professionally and provides strong documentation. Still, ToolBook's programming language, OpenScript, is stubbornly omnipresent (unlike Director's language, Lingo, which stays behind the scenes) and is hard to use, especially for beginners. We wouldn't bill it as "the world's easiest visual authoring system."—*Pauline Ores*

Multimedia ToolBook 4.0: CBT Edition

List price: $1,299
Requires: 386/33-based PC or better, 6MB RAM, 24MB hard disk space, Microsoft Windows 3.1 or later, VGA card, 2X CD-ROM drive **In short:** The CBT Edition is a must for any users—even Multimedia ToolBook programmers—who plan to incorporate CBT features into their titles. Point-and-click graphics features and prescripted items such as buttons make the required programming a little easier. But ToolBook's lack of an icon flowchart may make producing large multilinked titles difficult, and you need an add-on Database Connection for database access capabilities.
Asymetrix Corp., Bellevue, WA, 800-448-6543, 206-462-0501, fax, 206-455-3071, http://www.asymetrix.com. *Circle 467 on reader service card*

SUITABILITY TO TASK

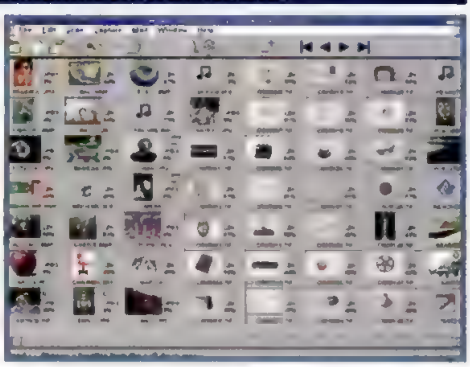
	Power	Ease
Interactive title development	Good	Good
Computer-based training (CBT)	Excellent	Good
Interactive catalogs/kiosks	Fair	Poor
Web authoring	N/A	N/A

N/A—Not applicable. The product does not have this feature

Firstlight VideoClips, from Firstlight Productions

This eight-disk CD-ROM video-clip series ($29.95 per disk), from Firstlight Productions (206-869-6600), covers subjects such as the environment, recreation, and world locations. Each title contains 120 full-motion video scenes, complete with remastered soundtracks. You can export the clips in either of two formats: 160 by 120 pixels or 320 by 240 pixels.

Media Commander, from MediaPaq



Media Commander ($129.95), the media database application from MediaPaq (800-554-0857, 602-813-3200), uses the familiar thumbnail method for presenting your media collection, be it sound, images, or video. Some of the more advanced functions you'll find in Media Commander include sound and notes attachment to images, on-the-fly compression of image files using either a JPEG or LZH compression algorithm, and an e-mail attachment function.

Our engineers blew out a few pocket protectors on this one.

Sam "Guru" Miller,
Manager, New Product Development

To say that ViewSonic's new PT810 SonicTron™ 21" (19.5" viewable) monitor has a great picture hardly does it justice. Actually, it's better than great. Even the most particular CAD/CAM/CAE users and desktop publishers are staring in wide-eyed amazement.

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Oracle Corp.

Oracle Media Objects

Oracle Media Objects 1.0.5 is a powerful and downright inexpensive cross-platform multimedia development environment aimed at commercial title developers, corporate users, and those with ambitions of publishing multimedia across a network—be it LAN, WAN, Web, or I-TV.

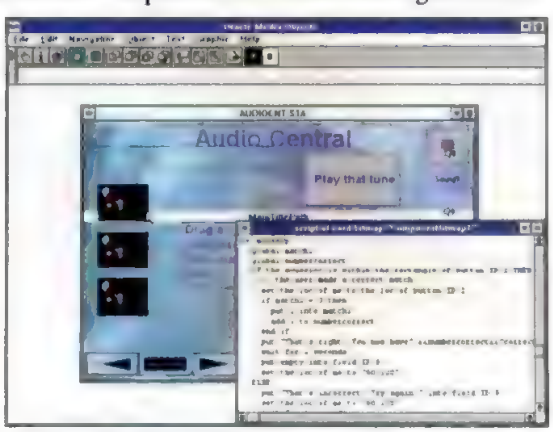
Media Objects, a 16-bit application that runs on Windows 3.1 and Windows 95, normally costs $495, but Oracle is selling it for just $99 through May 31, 1996. Media Objects traces its roots back to Oracle Card, a tool that emerged from the Hypercard phenomenon. This lineage shows up in Media Object's development metaphor: As in Asymetrix's Multimedia ToolBook and in Looking Glass's MediaVerse, you create Hypercard-like stacks of "cards"; each card is a screen of your application. The cards in a stack can share a single background, and you can add one more background per card. Both backgrounds and cards have layers on which media objects reside. The object types include text, graphics, video, audio, animation paths, timers, and interface elements (multiple buttons, pick boxes, datasheets, check boxes, and the like).

OBJECT LESSON

Developing in Media Objects involves four activities: producing or collecting media assets such as graphics, sounds, and videos; creating a hierarchy of stacks, cards, and objects; populating the objects with media assets; and scripting behaviors for the objects. Media Objects provides tools for every activity except media production, though the product includes paint and shape tools for basic work.

Media Objects supplies a graphical environment to create your application hierarchy. We quickly created a stack of five cards that shared a common background and pointed and clicked our way until we laid out all objects. Dialog boxes enabled us to set properties such as fonts, colors, styles, and transitions. On the background, we placed objects common to all screens, such as the title "Audio Central," "Back," "Next," and so forth. We began populating objects with bitmaps, .WAV files, and imported text. With the navigation facility, we had a visual prototype of the finished application.

The property box, visible in the foreground for the DataSheet, is a powerful Oracle Media Objects element.



This Oracle Media Objects script implements drag-and-drop for PC Labs' CBT matching task.

Next we assigned behavior to objects, cards, and stacks through an English-like scripting language. Cards respond to the event "open," which triggers on entry. Using a pull-down menu, we opened an edit box to script behavior for the background of the stack. We easily animated the title and glided into position on every screen.

We wrote a simple script, clicked on Run, navigated to the card, and the Audio Central banner slid into place (and did so on all of the cards in our stack sharing this background). A handler manages the "openCard" event on all cards sharing this background. You can also easily add user-defined events to any object.

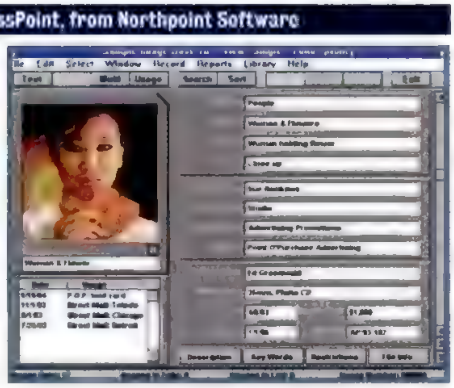
Though Media Objects lacks a class hierarchy of object classes, subclasses, and instances, the application hierarchy approaches the productivity of a fully object-oriented system. When you look down the hierarchy, you have containment: A stack, for instance, contains cards. And when you look up, you have message passing. Users new to programming should not fear this type of scripting for many tasks, such as displaying media and navigation, because Media Objects provides a clear method. The development environment supports the developer well, and it includes an excellent debugger and a window where you can interactively evaluate expressions. The hands-on tutorial and extensive documentation helps users easily form a mental model of how Media Objects works.

We especially liked the DataSheet, an editable combo box with rows and columns that can read ASCII text. Version 1.1 of Media Objects, which should ship by the time you read this, will have the Data Access Feature, which allows the DataSheet object to execute SQL commands against nearly any data source with the Open Client Adapter.

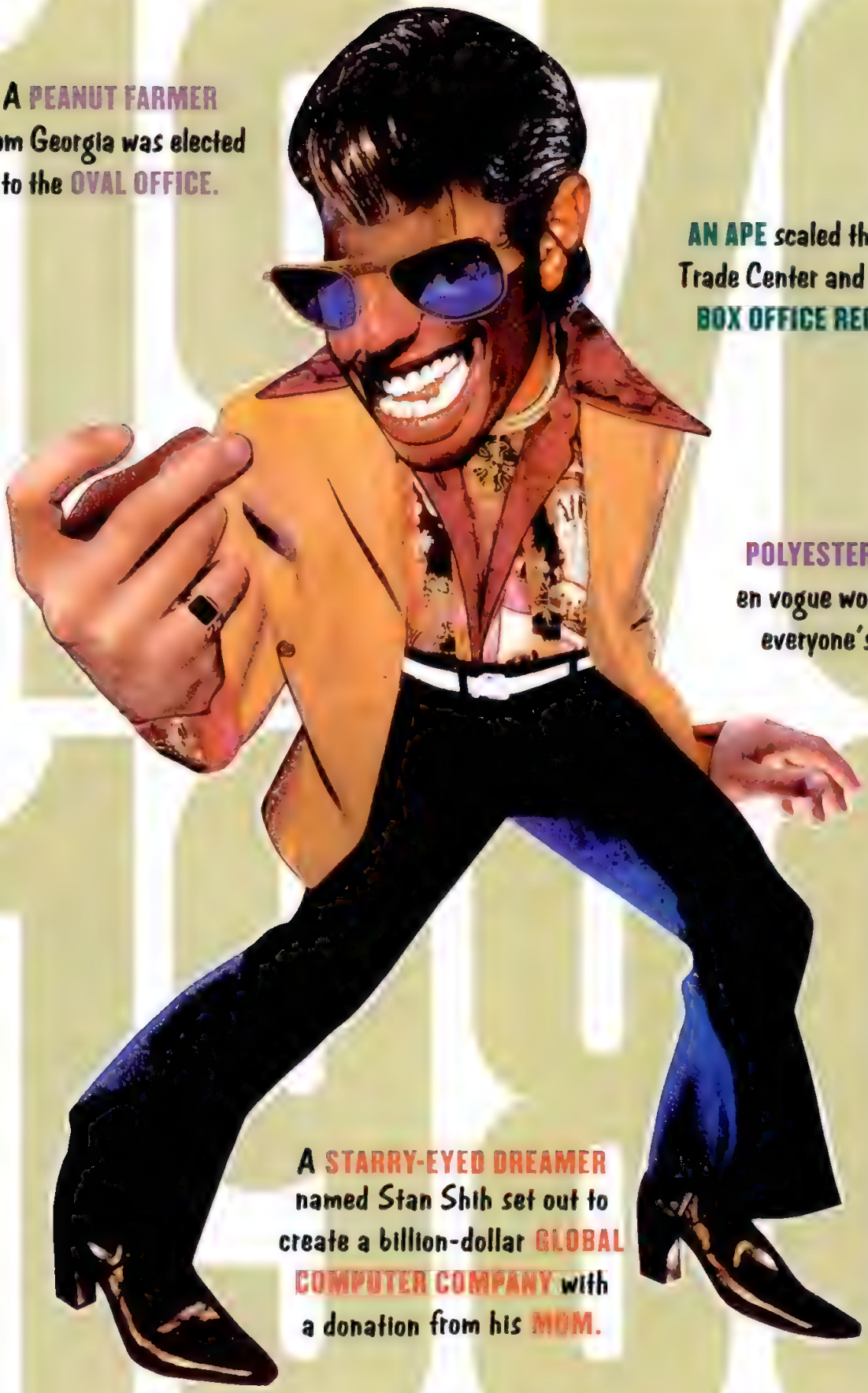
ABJECT OBJECTS

Did we love everything? No. Media Objects lacks direct support for .AVI, MIDI, Rich Text, and .FLC and .FLI animation

CompassPoint, from Northpoint Software



CompassPoint, a networkable image management system ($495 for a single user), from Northpoint Software (810-643-0200), can store up to 100,000 images per database. CompassPoint offers users such advanced features as database security, usage history, and on-the-fly compression of images in various formats.



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Stout first brother upholds the dignity of his brother's Presidential status by licensing his name to a beer company.

Jet-setting Europeans break the sound barrier at 30,000 feet on the Concorde's first commercial flight from Paris to London.

1977 During an interview, Stan Shih tells prospective employee William Lu the company may go bankrupt. 18 years later, Lu is president of Acer Computer International, managing millions in global business.

Who could possibly play a thin-as-a-rail droid in the most successful science fiction film ever? The 90-pound British actor who was thin-as-a-rail enough to fit inside his armor.

1977 Acer America Corporation is established by Stan Shih for manufacturing, assembling, marketing, and selling microprocessor-driven technology throughout North America.

Charlie's Angels *tops Nielsen ratings, proving that six-foot blondes with feathered hair are the archetypal detective heroes of the seventies.*

1976 When everyone else sees typewriters as the core of productivity, Taiwanese entrepreneur Stan Shih envisions the microprocessor as the engine of business.

After keeping a low profile for 3,300 years in an Egyptian tomb, King Tut flaunts his wealth across America in an extravagant seven-city tour.

Prank-happy, beer-swilling fraternity failures reach celebrity status when National Lampoon's Animal House *debuts on big screen.*

Human egg is fertilized outside female womb and world's first test-tube baby is born. And you thought hospitals were ster

1978 Acer assumes leadership role as high-tech gurus by opening a microprocessing center and training 3,000 engineers for Taiwan's information industry.

1978 To promote computer literacy in Taiwan, Acer publishes Microprocessor Bulletin and establishes credibility in med for microprocessing savvy.

Illustrations by Edmund Guy

1977 Multitech International begins incorporating microprocessors into electronic games and taps into rapidly growing consumer technology market.

The King of Rock and Roll dies and is born again in cheesy Vegas lounges where desperate actors don the jumpsuit and sideburns to eke out a living.

1979 Stan Shih's dignified business partner and wife Carolyn Yeh scrubs office floors and schleps around Taipei on a scooter distributing Acer bills.

Headband-sporting tennis prima donna trademarks his million-dollar recipe for success with racket-throwing fits and prolonged swearing-at-the-umpire outbursts.

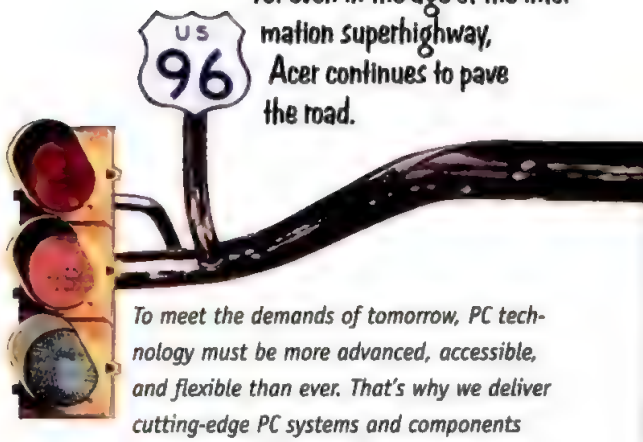
1980 Acer introduces Chinese language CRT terminal and subsequently receives Taiwan's most prestigious design award.

Millions show concern for a ruthless oil snake who destroys lives for pleasure when they tune in to watch the "Who Shot J.R." episode of Dallas.

Juggernaut Russian Ice Hockey team slips up to a bunch of college boys from the United States at the Lake Placid Winter Olympics.

1980 Acer starts mass-producing microprocessor-driven computer components for local manufacturers and begins exporting CRT terminals in bulk.

Who would have thought a company could be so far ahead of its time? Yet even in the age of the information superhighway, Acer continues to pave the road.



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files. Playing .AVI and MIDI required use of the included MOX, a media objects extension for MCI commands. This sufficed, but without the simplicity we found when we played QuickTime, which Media Objects supports directly. And we couldn't import animation and .RTF at all. Data masking and validation would complement the forthcoming SQL support. Lastly, Oracle could use a class hierarchy that would provide developers with all the advantages of object-oriented development.

By midyear, Oracle plans to release Version 1.5, a native 32-bit Windows 95 version of Media Objects with a plug-in for Netscape Navigator and PowerBrowser. Media Objects will act both as a front-end tool for multimedia on the Web and as part of a system in which you can stream media, such as video, off a server into Media Objects. Additional object support is slated for Version 1.5.

We enjoyed working with Oracle Media Objects, a robust cross-platform environment that provides a supportive yet nonintrusive card metaphor and has a straightforward, extensible scripting language that handled everything we threw at it. In the end, Oracle Media Objects landed high on our list.—*L&EVS*

Oracle Media Objects 1.0.5

List price: $99 until May 31, 1996, $495 thereafter **Requires:** 486/25-based PC or better, 4MB RAM, 2MB hard disk space, Microsoft Windows 3.1 or later, VGA card **In short:** Despite some shortcomings, Media Objects is a robust, cross-platform authoring tool with a strong, extensible scripting language and a future on networks of all types, including the Web **Oracle Corp.**, Redwood Shores, CA, 800-672-2531, 415-506-7000, fax, 415-506-7200, http://www.oracle.com *Circle 468 on reader service card*

SUITABILITY TO TASK

	Power	Ease
Interactive title development	Good	Excellent
Computer-based training (CBT)	Good	Fair
Interactive catalogs/kiosks	Good	Excellent
Web authoring	N/A	N/A

N/A—Not applicable. The product does not have this feature

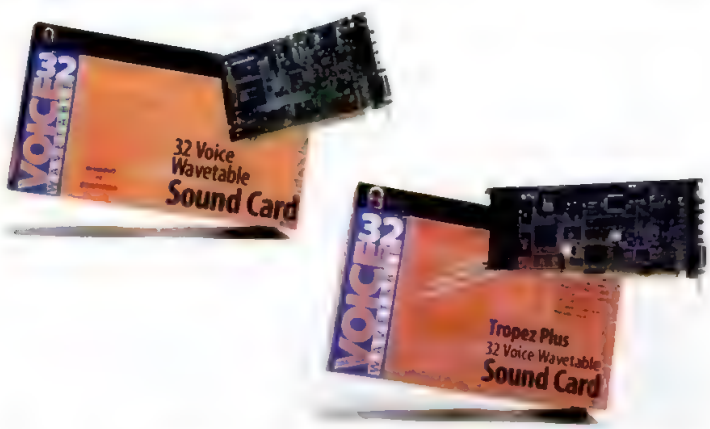
Allen Communication Inc.

Quest

Used as an icon-based authoring tool, Allen Communication's Quest 5.1 ($3,995) makes creating basic multimedia relatively easy despite some frustrating interface flaws. But users may find that more complex tasks, such as creating high-end learning applications, require the talents of a C programmer.

Quest, a Windows 3.1 application that takes an object-oriented approach to authoring, consists primarily of two sub applications: Title Design, in which you place, name, and link individual screens, or "frames," in an icon-based flowchart, and Frame Editor, in which you create, position, and/or program graphics, text, audio, or video. Quest also includes tem-

If you're not listening on Turtle Beach,



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plates, buttons, clip art, and a Release program to create runtime versions.

STARTING YOUR QUEST

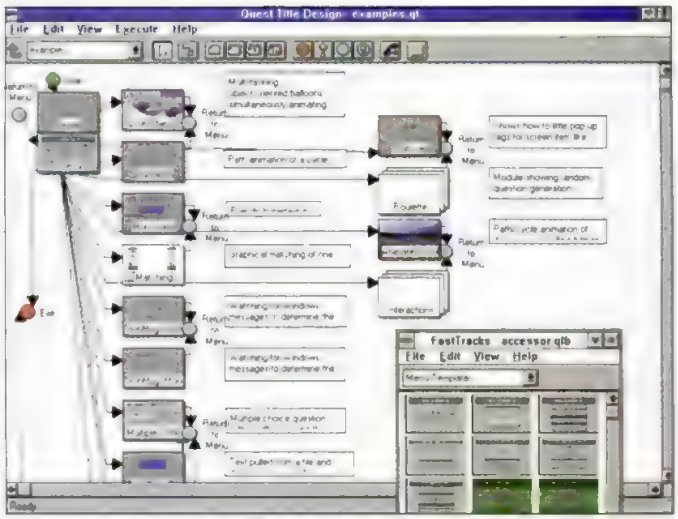
You start authoring in Title Design. There you place frames and modules and create links, paths, or connections between them via simple iconic, grid-based drawing tools. Modules consist of multiple frames; double-clicking on a module icon brings up a mini icon-flowchart area.

Overall, the intuitive Title Design provides an easy means to grasp the relationship between frames and the many multiple links. You can readily access a number of premade flowchart building blocks in the FastTracks window, which appears in both the flowchart and Frame Edit parts.

When you place a frame, an associated Item Properties dialog box appears, in which you can name the frame or browse to select a preexisting frame. Quest reflects any links created in the Title Design area as "flow options" in the Scripting dialog box available in Frame Editor.

You'll need a bit of time to get used to Frame Editor. Because the Frame Editor main menu displays lists of the scripted functions, it's a floating menu, yet you also save, open, and close functions there.

Some surprising flaws include an unindexed tutorial manual. Also, a Frame Edit palette window often disappears behind other screens, which can impede application design. Another problem is the use of two different text attribute palettes, one for text items (such as your application title) and another for text boxes, which display text from a file. Though the palettes can interact with each other, their different approaches don't let them share settings.



Quest Title Design's icon flowchart lets users easily plan a title, either from scratch or from templates accessed from the FastTracks window.

Quest lets you access simple graphics capabilities from a toolbar with folders for animation, audio or video, controls, and interactive behavior. Almost all toolbar options have associated dialog boxes. The

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selection tool resides in the Control toolbar, which also lets you create control items such as timers, buttons, and scroll bars. You select an item, locate an outside source file or define what you want from a corresponding dialog, and then place your item on the page. Quest has a unique way of treating bitmapped buttons: It requires users to create a single graphics file that stacks the two images needed to display an Unselected and a Selected button. You cannot stretch or scale these images to fit, so you must size them before you attach them to the button.

Scripting takes place in Frame Editor's Interact toolbar. You can select and arrange simple nested icon-based instructions, such as "watch for" and video and audio calls.

The Frame Edit window displays the results of your selections. You control the behaviors or object-user interactions on frames by rearranging and nesting icons of these object interactions in this list. You can expand or collapse these outlines, and even the most inexperienced user can easily create and grasp all the events on a per-frame basis. With the predrawn lists of Named Objects and Events that Quest offers, you could script a fairly complex CBT application without resorting to Quest C, a C-like programming language that can mix with Quest objects and object services. A debugging tool also works on both the simple object lists and Quest C.

To create something more than what you find in the catalog, you'll have to do some programming. Quest offers ODBC and the ability to work with DB3+ files, but to take advantage of those connections you need to be comfortable with C programming.

Programming aside, Quest's strength is obviously in basic CBT. Allen Communication gears Quest's examples (such a matching game and a variety of multiple-choice templates) toward creating learning applications. (Quest doesn't provide any examples for interactive catalogs, so you'll have to program for that.) The more elaborate examples illustrate just how much you can accomplish by programming in Quest C. Currently, you can play back on Windows 3.1 and Windows 95. And Allen Communication is working on a native Windows 95 version of Quest that will add Web authoring abilities.

While we found minor flaws with the Frame Editor interface, the ease of creating of a multimedia application impressed us. However, because certain complex events and object interactions require programming in Quest C, this package may best suit someone with deep pockets and a programmer's mind.—*PO* □

Quest's Frame Edit application offers two text attribute windows, one for screen text and another for text boxes.

Quest 5.1

List price: $ 3,995
Requires: 486/33-based PC or better 8MB RAM 10MB hard disk space, Microsoft Windows 3 1 or later, VGA card **In short:** Quest consists of two interrelated mini-applications: an icon flowchart that determines all the links between "frames" and a frame editor in which you produce the graphics and programming for each frame You can select and arrange simple nested icon-based instructions, but anything beyond that requires QuestC, a version of C
Allen Communication Inc., Salt Lake City, UT, 800-325-7850, 801-537-7800, fax, 801-537-7805, http://www.allen-comm.com *Circle 469 on reader service card*

SUITABILITY TO TASK

	Power	Ease
Interactive title development	Good	Good
Computer-based training (CBT)	Excellent	Good
Interactive catalogs/kiosks	Good	Fair
Web authoring	N/A	N/A

N/A—Not applicable The product does not have this feature

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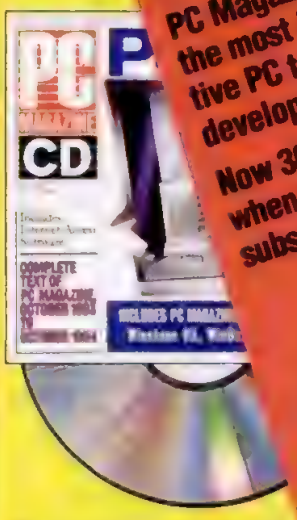

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CUSTOMIZABLE NEWS SERVICES

News You Choose

Suffering from information overload? These 12 customizable news services deliver just the news you're looking for while filtering out the rest.

SCREEN IMAGE BY JACK HARRIS/VISUAL LOGIC, PHOTOGRAPH BY THOM O'CONNOR

By Michael W. Muchmore

With a modem or an Internet connection, you get access to literally thousands of news and information sources. But what good is all this information if you can't find what you need? Fortunately, customizable news services, available online or on the Internet, let you zero in on just the news that's important to you, while filtering out the noise.

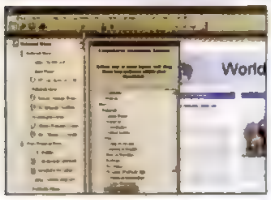
We've evaluated 12 custom news services that can give you daily updates on the news topics that interest you. All of them let you select what you want either by using a list of general news topics or by specifying search terms. Then they send the relevant news stories or summaries into your e-mail in-box, onto a custom Web page, or into

IN THIS REVIEW

Custom Clips 201
EyeQ 1.11 202
Farcast 207
fishWrap 208
HeadsUp 210
Infoseek Professional 212
Internet News Alert 212
Journalist 216
NewsGrid 217
NewsHound 218
Personal Journal 220
Profound 222
Editors' Choice 201
Custom News for the Corporate Site 208
Summary of Features 216

Customizable News: Your Choice

CUSTOM SOFTWARE ($5-30 per month)



- Custom Clips
- EyeQ
- Journalist
- Newsgrid
- Personal Journal
- Profound

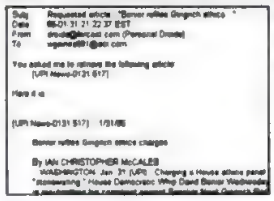
Services that provide their own interface software tend to be more customizable and richer in information. On the downside, they also tend to be more expensive and are limited to the speed of a modem connection.

WORLD WIDE WEB ($5 per month)

- fishWrap
- InfoSeek Professional
- Internet News Alert

Web-based services tend to be inexpensive, and they can deliver as fast as the fastest Internet connection. At this point, though, they don't offer as much content or as many customization options as the other types.

E-MAIL SERVICES ($5-30 per month)



- Farcast
- HeadsUp
- NewsHound

E-mail news services deliver automatically: You don't have to start up a program or log on to a Web site to request your news. A disadvantage is that you have to wait for response e-mail after requesting full text articles.

a proprietary communications program. All of the services let you save queries or news profiles for repeated use. Ranging in price from free to approximately $50 a month, they're relatively affordable.

STATE YOUR SOURCES

The services vary enormously in where they get their news, but most use at least one of the big news wires: Associated Press (AP), Reuters, or United Press International (UPI).

Many of the services, such as NewsHound and Profound, also get their news from newspaper conglomerates, such as Knight-Ridder/Tribune News Service, which offers articles from the *Chicago Tribune*, the *Miami Herald*, the *Philadelphia Inquirer*, and many other major newspapers. McClatchy Newspapers and Scripps-Howard News Service provide information from smaller newspapers. Financial quotes, often coming from Quote.Com, are available from many of these services on at least a 15-minute delay (real-time stock-quote feeds are a much higher-ticket item).

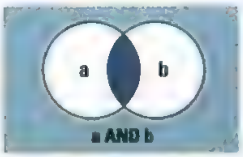
Some services, such as Farcast, Infoseek Professional, and NewsGrid, add specialized news wires, such as A.M. Best (insurance), BusinessWire and PR Newswire (press releases), Federal News Service (U.S. Government), Futures World News, Newsbytes (computer-related), Sports Network, Standard & Poor's MarketScope, and US Newswire (government news).

The most in-depth services, like Custom Clips, EyeQ, and Profound, add industry-specific newsletters, detailed reports on individual companies, or even transcripts of television news. Some of the services let you narrow your searches by source as well as by topic.

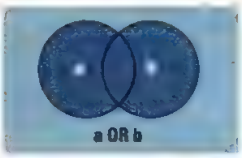
Customizable news services offer two basic ways to specify the news you want: by selecting from predefined lists of topics or by building a query using search terms. There are services that just offer a topic list and others that only have keyword searching; the most accommodating offer a combination of the two.

Boolean Operators

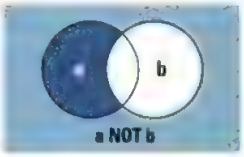
Shaded areas represent included results.



AND is a way of limiting or narrowing your search. AND returns only records that contain all of the specified search terms. For example, searching for "cat AND mouse" will return only records that include both "cat" and "mouse."



Using **OR** as a connecting word returns all records that include at least one search term. It is useful when there's more than one way to express a concept ("laptop OR notebook") or to spell a word ("czar OR tsar").



NOT is a way of excluding certain terms from your search. A search on "butterfly NOT IBM" returns all articles about the insect but not those about the laptop. Be careful about using NOT; you may exclude relevant data.

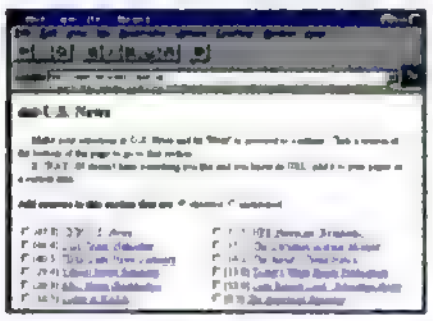
Each way of specifying your interests has its advantages and drawbacks. Obviously, topic lists are only good if your topics are in the list. The problem with services that only use search terms is that you're likely to get a lot of articles that mention your search term in passing but are not really about your topic. Services that offer the Boolean search operators AND, OR, and NOT give you much more powerful tools for zeroing in on what you're really looking for (see diagram). Some services also let you use standard wild cards in a search string, and some let you specify proximity or how close to one another the search terms must be.

HOME DELIVERY

There are three basic ways that these services deliver your daily allotment of news. Some of them, Farcast, HeadsUp, and NewsHound, for example, use your e-mail in-box. Another group (fishWrap, InfoSeek Professional, and Internet News Alert) use an updated, personalized Web page: These methods offer speed and convenience. Some services, such as EyeQ, Personal Journal, and Profound, have their own interface. They are more expensive, but they tend to be more powerful too.

All the services we evaluated organize groups of articles in one of two standard ways. The simplest is by date, typically with the most recent articles on top. The other is to rank articles by relevance. This feature pertains only to articles obtained through a query, since the relevance score is derived from the number of occurrences in the articles of your specified search terms. One service, EyeQ, lets you rank stories by relevance, source, or date. Surprisingly, only two of the services offered significant nontext content. PointCast's Journalist offers images, and Profound uses graphics-inclusive Adobe

PERSONAL LINK SITES (free)



- Crayon
- SIFT
- Microsoft Network home page
- Your Personal Newshare

These Web sites let you create a personalized page with links to news sites on the Web. They're free, but they don't let you choose specific news topics.

HIGH END CORPORATE NEWS FEEDS ($6-100,000 per year)

- Bloomberg Business News
- CNN at Work
- Dialog Alerts
- DowVision
- First
- Hoover
- Lexis-Nexis
- News Alert
- NewsEdge
- Relevant Personal Edition
- Reuters Business Alert

These high-power, multiuser services deliver news feeds to corporate LANs, often via satellite, cable, or leased lines. They're the most customizable, the most immediate, and the most comprehensive in content, but they're obviously outside the average user's price range.

Acrobat files. Several of the services offer optional fax delivery.

EVALUATING THE SERVICES

To test the services, we set up structured tests which served as the basis for the Topic Strength ratings included in the evaluations of each product. We designed 18 queries in six major topic areas for each of the services we evaluated, using each service's native query tools. We then checked the resulting articles to see how well each covered the subject area, whether we also received a high number of irrelevant hits, and whether we got duplicate articles. We tested each service on the same topics over the same period of time.

If you're interested in exploring high-end news feeds targeted at corporate sites, take a look at our survey of 11 offerings (see the sidebar "Custom News for the Corporate Site"). We also looked at the other end of the spectrum: free customizable Web pages that don't provide their own news but let you build a custom page with links to external news sources (see the sidebar "News Link Web Pages: A Useful Alternative").

Another alternative is ClariNet Communications' e.News (*http://www.clarinet.com/*), a newsgroup feed available from many Internet service providers that lets you subscribe to your choice of about 500 narrowly defined topics. ClariNet has expanded its content to 2,000 stories a day and added pictures, comics, and sports.

While offerings from Time Warner's Pathfinder and the Microsoft/NBC venture weren't ready for us to include, we were able to take a look at IBM's soon-to-be-released infoSage (see the sidebar "Sneak Preview: IBM's infoSage").

No matter which type of service you choose, you'll be in a stronger position to fight info overload. The evaluations that follow show you what each service offers, how well you can customize it, and how your custom news is delivered.

Dow Jones Business Information Services

Custom Clips

Business people who want a wide choice of sources will do well with Dow Jones' Custom Clips. But unless you define your search criteria narrowly, some irrelevant information will show up. The subscription fee of $15 a month for five search profiles (plus $1.50 per 1,000 characters) includes initial setup, support, and the ability to change your list of topics with a simple phone call.

A part of Dow Jones News/Retrieval

Profound

Every customizable news service we evaluated can be useful to the right person. Your choice will depend on the sources you want, and the delivery medium you prefer. Nevertheless, our Editors' Choice winner stands out above the rest.

Not only is Profound's list of sources immense, it goes beyond all the other services in offering articles in their original document layout with graphics. And for what you get from Profound, its price of $19.95 a month and $6.95-an- hour connect time is quite reasonable.

Profound gets current news, which is updated hourly, from major wire services and news publishers, including more than 4,000 newspapers, magazines and journals from 190 countries. Much of this news is provided in full color graphical format.

Business data is provided on more than 300 market sectors, the economies of more than 100 countries, and more than 4,600 U.S. companies. Stock prices, futures, metals, commodities, options, and foreign exchange quotes are also available.

Profound deposits all this information into a database that's indexed by date, market sector, company, country, publisher, and subject.

Its Custom Alerts feature, which notifies you when new information has been found on a topic you specify, is a convenient way to stay on top of news developments that interest you.

All of this is accessible through a clear, intuitive Microsoft Widows interface program. The result is that Profound makes it easy for you to get timely, comprehensive, well-targeted news in a clear, graphical format.

If you're looking for a low-cost solution, consider the e-mail–based NewsHound. It delivered the full text of pertinent articles for only $4.95 a month.

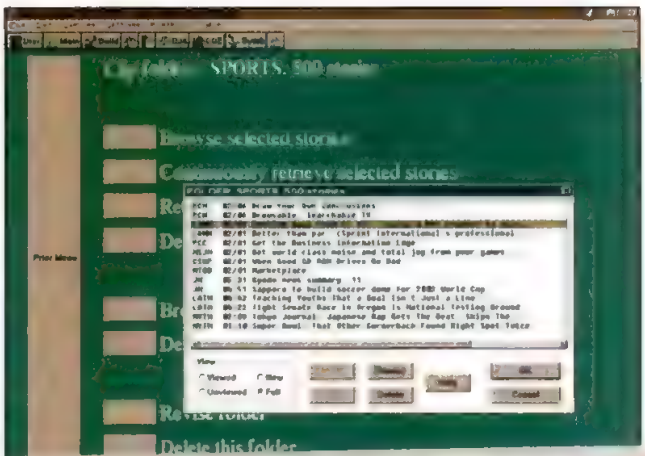
(DJ N/R), Custom Clips draws its news from over 2,700 sources: the major wire services, newspapers (including *The New York Times* and *The Wall Street Journal*), and trade publications. Some truly obscure sources are represented, and Dow Jones claims that many are not available elsewhere.

A simple DJ N/R Windows interface has menus in which you specify the sources you want to use. You enter words into a text box that supports Boolean operators and proximity modifiers. The interface is slow, there are no off-line capabilities, and you'll find only minimal help.

After specifying sources and entering search terms, you choose a method of delivery: online (in the provided Windows software), fax, or e-mail. While e-mail is the most convenient delivery method, we found setting it up to be rather tedious.

We connected to DJ N/R via SprintNet, a public packet data network. We sometimes had trouble establishing a connection, and downloading messages was quite slow, even at 28.8 Kbps.

Some of the categories we defined hit the maximum of 500 stories within a few days, but many were of dubious value. The first baseball story we got was the introduction to a *PC Magazine* review of presentation graphics software (the story contained a reference to presentations that look like baseball diamonds).



SUITABILITY TO TASK	
Custom Clips	
Ease of setup	Fair
Customizability	Good
Quality of delivery	Good
TOPIC STRENGTH	
U.S news	★★★★
World news	★★★★
Business	★★★
Sports	★
Arts & entertainment	★★
Technology	★★★

Custom Clips lets you define filters from particular sources in a folder. You then browse them online or have them sent to your e-mail account.

Custom Clips doesn't attempt to determine the relevance of a hit; it just looks for the filter words in the story.

The service most similar to Custom Clips in number of sources and power is DataTimes' higher-price EyeQ.

Custom Clips' broad coverage for business and general news distinguish it, but unless you can formulate accurate search filters, prepare to be overwhelmed by the amount of data and underwhelmed by the software.—*Larry Seltzer*

Custom Clips. List price: $15 per month, plus $1.50 per 1,000 characters. Dow Jones Business Information Services, Princeton, NJ; 800-445-9454, 609-452-1511; fax, 609-520-4068; http:/bis.dowjones.com/cclips.htm. *Circle 474 on reader service card.*

DataTimes Corp.

EyeQ

Vast news resources and advanced searching capabilities distinguish DataTimes Corp.'s EyeQ 1.11. At $39 per month plus a $12-an-hour connect charge and a surcharge of $3 for accessing each full-text document, it's the priciest in this evaluation, but it returned an impressive number of good hits for our test topics.

EyeQ uses a slick Windows 3.1–based

CUSTOMIZABLE ONLINE NEWS SERVICES

How to Read the Suitability to Task Boxes

Electronic newspapers have gone beyond simple online delivery; now they allow subscribers to get their own custom editions of the news. The offerings are still far from perfect though, so we tried to sort out their strengths and weaknesses for you.

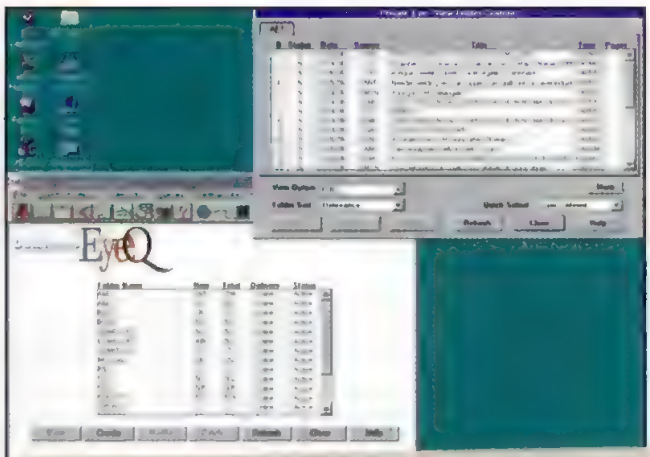
Ease of setup indicates how easy it is to set up and navigate the service. Are screens clearly laid out? Is the interface easy to navigate? For packages that required custom software, we looked for intuitive installation and strong documentation.

The **customizability** score indicates how precisely you can pinpoint the news topics you want to receive. The ideal service offers an extensive, well-organized selection of topics as well as powerful searching capabilities that include Boolean and proximity operators and search-string wild cards.

Quality of delivery is a measure of how well targeted and comprehensive the news we received actually was. Points were taken off for three typical problems: insufficient information on the topic, a high number of irrelevant news articles, and duplicate articles. The ability to rank result articles by relevance was considered a plus for this category.

SUITABILITY TO TASK	
Product Name	
Ease of setup	Poor
Customizability	Excellent
Quality of delivery	Poor
TOPIC STRENGTH	
U.S. news	★★★★
World news	★★★
Business	★★
Sports	★★★
Arts & entertainment	★★
Technology	★★★★

Topic strength ratings are designed to help you choose a service based on your interests. They measure the amount and quality of content in six areas. We tested each service on each topic using both broad queries (for example, "baseball") and specific queries ("Don Mattingly"). The score for business includes a service's ability to track a stock or company and provide detailed financial news. Our technology topics include both computer and general-science subjects. The highest rating a service could get is four stars; one star is the lowest.



EyeQ draws on thousands of news sources and ranks articles in your Private Eye folders by relevance, showing the date and source of each one.

SUITABILITY TO TASK	EyeQ
Ease of setup	Excellent
Customizability	Good
Quality of delivery	Good
TOPIC STRENGTH	
U.S. news	★★★★
World news	★★★★
Business	★★★★
Sports	★★
Arts & entertainment	★★
Technology	★★★

communication program rather than the Internet to communicate with Datatimes' news feeds. The software installs easily under Windows 95 and includes presets for most standard modems. After we chose an access number from the help system, we were ready to access about 5,000 news, industry, and financial services from around the world. This staggering list includes newspapers from 48 states and most foreign countries with significant business activity, national magazines (including *PC Magazine*), news wires, trade publications, and transcripts of TV news. Financial services include quotes, historical financial data, and reports on some 30,000 companies worldwide. A source selector lets you limit the information you receive by industry or region.

EyeQ's Private Eye feature lets you create and view custom profiles, which are updated continually. Each fine-search folder costs an additional $15 per month. You can define a Private Eye search in one of two ways. The first uses a natural-language "Who, What, Where, When" search interface that's well suited for non-technical users. The second uses standard Boolean operators and proximity terms and lets you specify whether the search terms should be in the headline or the text of the article. Both search interfaces let you define the time period covered and limit the sources searched.

Private Eye displays your searches in a spreadsheet-like list that shows you the number of articles found. Double-clicking your mouse on a search shows you a list of headlines, each with its source, date, and associated number of pages. You can sort your results by relevance, source, or date. Highlighting a headline lets you view the full text of an article with your search keywords highlighted in red.

While its price may exclude the casual news surfer, EyeQ is a strong and broad-based business tool whose results justify the expense.—*Michael W. Muchmore*

EyeQ 1.11. List price: $39 per month, $12-per-hour connect charge, and $15 per 5 profiles; additional charges for full-text documents. Datatimes Corp., Oklahoma City, OK; 800-642-2525, 405-751-6400; fax, 405-755-8028; http://www.datatimes.com. *Circle 475 on reader service card.*

Farcast Inc.

Farcast

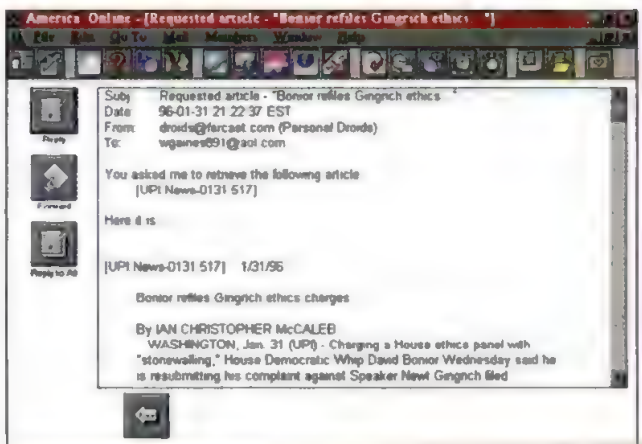
If you've ever dreamed about having droids work for you, you don't have to wait for the future. Farcast droids are powerful tools that fetch information from a wide range of news and financial sources and deliver it to your e-mailbox. The cost? A reasonable $9.95 a month.

Droids are customized processes stored in the Farcast system; you interact with them entirely through e-mail—there's no separate interface software. To start a droid working for you, you send it an e-mail in a particular format. The droids search the nearly 15,000 articles that come through Farcast daily and mail the results to you over the Internet. You can customize up to 5 personal droids for the basic price.

Document types and source publications are also represented by droids. To get stock quotes, for example, you send a request to the Stock Droid; for news, you ask the Newsstand Droid. There's even a Help droid to get documentation, and you also get a helpful pocket-size manual when you sign up.

Farcast's extensive sources include AP, BusinessWire, Newsbytes, PR Newswire, and UPI. It can also provide you with 24-hour financial quotes.

The key to success with Farcast is careful construction of your requests. Our early problems in requesting news resulted from syntax errors. The To, Subject, and Message body areas of your mail must all contain the correctly formatted information to get the right results. One



Farcast droids respond to your Internet e-mail requests with a message like this, showing you article headline, source, and date.

SUITABILITY TO TASK	Farcast
Ease of setup	Good
Customizability	Good
Quality of delivery	Excellent
TOPIC STRENGTH	
U.S. news	★★
World news	★★
Business	★★★
Sports	★★
Arts & entertainment	★
Technology	★★★★

Custom News for the Corporate Site

By Tony Pompili

Politicians say information is power, but you need look no further than a trader's desk to see that for businesses, information also means money. Whether power or money is your objective, the more people in your organization with easy access to up-to-date information, the more potential there is for acquiring both. That is why smart firms turn to high-end news delivery services for that extra edge.

Few applications can leverage an investment in LANs as well as corporate news delivery services. Some news services offer products that dovetail nicely with existing corporate information-distribution applications such as Lotus Notes. Others are beginning to build on intranet installations, supplying World Wide Web–style HTML documents.

Many corporate news-service names—such as Bloomberg, CNN, and Reuters—have a familiar ring to them. These companies' services exploit their already strong news-content assets. Other services, First!, for instance, add redistribution options and customized profiles or combine several news feeds. A third group, such as NewsEdge, offer repackaging technology that customizes and delivers news feeds to existing corporate information structures.

Content on these high-end news services is specifically aimed at businesses—unlike many personal services, which include information on such topics as sports. Although some of these high-end services can perform Web searches that furnish nonbusiness-oriented information, most of the services included here offer hard business news, company information, and stock quotes.

They're also not particularly cheap. Expect services to range from $20,000 annually for a handful of users to over $100,000 per year for larger sites. After all, as the business community quips, it takes money to make money.

SERVICES WITH HOMEGROWN CONTENT

It's common these days to pick up a newspaper and see the name of one of these services in the dateline. They're the big business news wires. These services include Bloomberg Business News, CNN at Work, Dow Jones' DowVision, and Reuters Business Alert. Each develops its own content, which often turns up in such other services as Dialog Alert and NewsEdge.

A big name in this group is Dow Jones' **DowVision.** The foundations of this service are Dow Jones' own sources: the AP–Dow Jones International News Service, Capital Markets Report, Professional Investor Report, *The Wall Street Journal*, and the Dow Jones International News Service (with stories on over 10,000 companies).

DowVision also offers the full texts of both *Barron's* and *The New York Times;* selections from Federal Filings; Japan Economic Newswire; and stock quotes. Optional, surcharged sources include the *Financial Times* of London, *The Los Angeles Times,* and the business sections of over 50 American regional newspapers.

DowVision is delivered as a raw wire feed directly into a local customer's server. A 100-user site costs about $30 per month per user.

Reuters is another top player among the handful of in-depth worldwide news content providers. Its New Media division offers **Reuters Business Alert,** which gives users access to Reuters news services as well as to a variety of other publications and wires. Business Alert also brings you the world's leading newspapers, including *Le Monde, The New York Times,* and *The Wall Street Journal.*

Reuters supplies Business Alert Server software; one of the available configurations allows users to access its news through Lotus Notes. Reuters has also created custom Notes databases with special search features that allow users to point and click on items to search for. Reuters Business Alert costs

nice thing about the system is that you have to create a droid only once, so even cumbersome searches can be done daily with absolutely no intervention on your part.

Search results were extremely accurate, with few irrelevant messages. From each droid you receive one message with a headline for each article that matches your search. Using a reference number provided with the headline, you get the full text of the article for no additional charge. As with most of the services here, results are returned as text only.

Accurate and thorough news with convenient delivery to your e-mail box makes Farcast a good choice. You might find talking to your droids in batch-style search terms somewhat confusing, but it's worth the trouble: They work hard for you. *—Tony Pompili*

Farcast. List price: $9.95 a month per 15 droids. Farcast Inc., Menlo Park, CA; 415-327-2446, fax: 415-327-5603; http://www.farcast.com. *Circle 476 on reader service card.*

The Gate

fishWrap

It's far less customizable than most of the other services we reviewed, but fishWrap, a Web-based custom news page offered by The Gate (a joint Web site of the *San Francisco Chronicle* and the *San Francisco Examiner*). fishWrap is a pioneer among newspaper Web sites. It uses technology developed by MIT Media Lab's News in the Future project; it looks good, costs nothing, and is quite useful.

All the news in fishWrap comes from the AP wire and you don't get keyword search tools or e-mail notification. There are only two ways to customize fishWrap: by geographic region and by topic. After

OUR CONTRIBUTORS: MICHAEL MUCHMORE is a staff editor of *PC Magazine.* TONY POMPILI is a contributing editor of *PC Magazine,* and WILLIAM GAINES is a freelance technical writer. LARRY SELTZER is a technical director at *PC Magazine.* THOMAS MACE was the senior editor in charge of this story.

$950 per person a month for ten users.

Bloomberg Business News emphasizes real-time, multimedia delivery of business news and stock quotes, but it also offers a variety of nonbusiness services. In addition to text, Bloomberg delivers sound, graphics, and freeze-frame video to either a multimedia PC or a Bloomberg proprietary terminal. The latter connects directly to the service over 56-Kbps or 64-Kbps leased lines. If you use your own PC, you connect through a local gateway to the Bloomberg system. The service's price is $1,090 per terminal.

CNN at Work, developed in cooperation with Intel, delivers live video and text news via cable or satellite connection to networked PCs in a Windows interface. In addition to CNN, CNNfn, and Headline News, you can get a spreadsheet-like table of your stock portfolio and information from *Fortune*, Knight-Ridder, Lexis-Nexis, Reuters, and *Time*.

All content is filtered for each user's personal profile, which is defined using preset subject or industry topics or keywords. News is captured to an inbox on your hard disk in chronological order. Optional alerts can beep or pop up to tell you that a story of interest has appeared. CNN at Work also lets you distribute in-house videos.

CNN at Work integrates live text and video feeds in its Viewer application.

The required multimedia gateway that transforms the analog signal to a digital format is $4,995, and the service costs $120 per user per year.

SERVICES THAT BRING A NEW TWIST TO THE CONTENT

Several services that deliver corporate news are built around the service provider's repackaging of the original news content. These services try either to improve the access or to make it possible to customize news data more precisely for specific groups.

Individual's **First!**, a corporate news service, gets source information from over 600 newspapers and periodicals. Besides the company's back-end processing engine that categorizes and removes redundant articles, the company also has an editorial staff that maintains keyword lists for selecting stories; they ensure that information is accurately classified.

First! delivers profile results into Notes databases, FolioViews, or HTML formats. A ten-user First! system that receives an average of 100 articles a day costs about $30,000 annually.

Ensemble's **Relevant Personal Edition** specializes in repackaging popular newspapers into an electronic newspaper format. Relevant delivers such titles as *The New York Times* and *The Wall Street Journal* in a quasi-newspaper layout with banners and text. There are, however, no graphics or photographs. You can create a personal digital newspaper with stories gleaned from Dow Jones' DowVision.

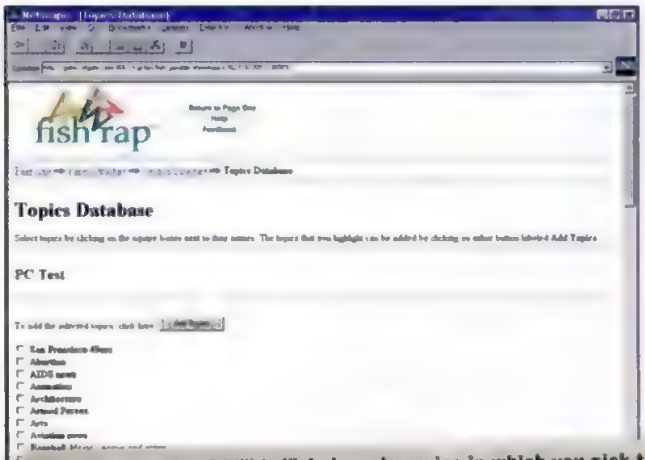
Ensemble delivers shared and personal newspapers to customer sites as HTML documents. Ensemble uses either its own proprietary client software or NetScape Navigator. Ensemble client users get their papers delivered as e-mail attachments and view them with the client. Web-browser users acquire

Continues

you've given fishWrap your location, it can produce a hometown news section in your custom paper with stories for your city and state. You'll also receive a standard selection of national and international topics.

To customize by topic, you create named sections for your personal paper, which you populate with choices from a list of about 70 topics. The list has some interesting and offbeat topics but isn't comprehensive. Basics like politics and technology were missing, and the topics have a San Francisco Bay area slant. You can add or delete sections and topics at any time, and a filter lets you exclude sports news from any section.

When you access fishWrap to check on your personal news, the first thing you see



SUITABILITY TO TASK	
fishWrap	
Ease of setup	Good
Customizability	Poor
Quality of delivery	Fair
TOPIC STRENGTH	
U S news	★★★
World news	★★
Business	★
Sports	★★★
Arts & entertainment	★★
Technology	★★

fishWrap is a World Wide Web-based service in which you pick topics from a set list for each section of your own electronic newspaper.

Custom News for the Corporate Site

Continued

their daily papers through Ensemble's Web site. Relevant Personal Edition is priced at $35 per user per month for 100 users.

Information resellers have also gotten into the customized corporate-news business. Online reference kings Dialog and Lexis-Nexis offer their vast breadth and depth of information—with thousands of sources available—to corporate-customer news feeds. Both services offer cross-source searching, which lets user create daily, weekly, or monthly searches.

Lexis-Nexis Trackers find articles from over 5,800 sources either about a specific company or with a customized set of search words. To receive updates, a customer's Notes server replicates with Lexis-Nexis or WorldCom, a public replication service. Client sites can replicate as often as five times daily.

A Company Tracker costs $248 per month for 20 users or $499 for 100 users. Custom Trackers are more expensive: $499 for 20 users and $999 for 100 users.

Dialog makes its broad range of information customizable with **Dialog Alerts.** Profiles that work within a multi-source Dialog database are created by an experienced Dialog specialist at the customer's site.

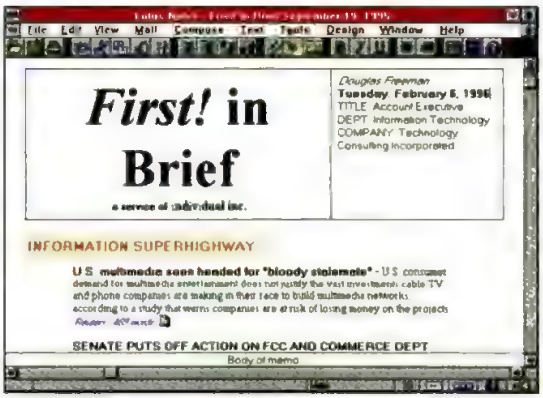
Alert news is delivered as full text to one or more users' e-mail boxes. While the company does not offer local server delivery, Knight-Ridder cosponsors a product called Data Junction, which converts e-mail files into such shared database formats as Notes and Microsoft Access.

Dialog Alerts' prices are based on the number of profiles and the databases being consulted. Typically a single profile costs $1 to $2 per day and $1 to $5 per full-text article found.

SERVICES THAT BRING CORPORATE NEWS TO YOUR LAN

If you're keen on a particular service such as DowVision but don't particularly like Dow Jones' delivery options, several companies offer products that integrate news-feed information with your existing information delivery mechanisms. These applications take care of everything from interfacing with the news service (whether that means installing a land line, an FM receiver, or a satellite) to chopping the feeds up into individual documents, to adding them to specific databases.

One such package is SandPoint's **Hoover,** which converts news feeds into Notes databases. Hoover will also allow users, through the Notes server and Hoover processes, to call database services such as Disclosure and request a 401K on a specific company. Hoover and the news service prices vary depending on the number of users and the service type. Installations typically run from $28,000 to over $100,000 annually.



First! can deliver a Notes database populated with news that matches each user's profile.

Similar to Hoover, Desktop Data's **NewsEdge** presents news delivery technology that offers customers complete control over the type and the organization of information they receive. NewsEdge runs either on its own server and Windows client or with Lotus Notes. Again, as do Hoover's,

is Page One. This page, essentially a communal news board, is the same for all users, and any user can nominate a fishWrap story for all other users to see there. To view your own custom sections, you click on Generate New Edition. This takes you to the sections page, which shows your hometown news and custom sections, with links to your chosen topics. Clicking on a topic brings up a list of hyperlinked story headlines, each followed by the first 40 or so words of the article; clicking on a headline brings up the full text. Articles remain accessible for 48 hours after they're posted. We found that topics were generally well filtered, although irrelevant stories did crop up.

fishWrap is decidedly on the light side compared with many other services. But it's a start, it's free, and the interface is well designed.—*MWM*

fishWrap. List price: Free. The Gate, San Francisco, CA; 415-777-7677; http://www.sfgate.com. *Circle 477 on reader service card.*

Individual Inc.

HeadsUp

Primarily targeting business users, HeadsUp delivers one of the richest, best-targeted news feeds of the products we evaluated. HeadsUp sends abstracts of news stories to your Internet e-mail box for a flat $29.95 monthly rate. You can also get the full text of an article in about 30 minutes; the first five are free with each additional article costing $2.97.

To register for HeadsUp, you simply fill out a Topic Selection form, which you then either send to Individual via e-mail or fax. A topics description manual helps you choose up to 10 topics from the more than 2,400 topics offered. While you never actually enter a query, you can work with an Individual staff member to help you decide which topics fit your needs.

HeadsUp gets its information from more than 630 sources at Individual's disposal, including newspapers, news wires, trade periodicals, and industry newsletters. Individual also offers a less expensive subset of HeadsUp, called iNews ($14.95 plus 99 cents per article),

NewsEdge servers on customer sites connect directly to news service providers such as AP, Dow Jones, Knight-Ridder, Reuters, or UPI. NewsEdge is also available for the Macintosh, OS/2, and Unix.

Pricing per 100 NewsEdge users is typically $55,000 and includes a variety of basic business feeds including BusinessWire and PR Newswire. DowVision, Reuters, and other services are available as options.

News Alert provides sites with a Unix-based system for collecting, updating, and distributing business news. News Alert software runs on Sun Solaris 2.3 or 2.4 systems and performs such tasks as full-text indexing and dividing up data streams into stories. News Alert clients use TCP/IP to network with the News Alert service.

News Alert provides its own Microsoft Windows 3.1, Microsoft Windows 95, or Unix client software; it allows users to read and search for stories as well as to create custom Alerts. A typical News Alert system for 150 users costs $25,000 for the server and $18 per user per month.

Ensemble's Relevant Personal Edition offers a customized Web-page version of DowVision.

CONTACT INFORMATION

Bloomberg Business News. Bloomberg L.P., New York, NY; 800-357-7555, 212-318-2700; http://www.bloomberg.com. *Circle 486 on reader service card.*

CNN at Work. Intel Corp., Hillsboro, OR; 800-538-3373; http://www.intel.com/commnet/cnn_work/index.html. *Circle 487 on reader service card.*

Dialog. Knight-Ridder Information Inc., Mountain View, CA; 800-334-2564, 415-254-8800; http://www.dialog.com. *Circle 488 on reader service card.*

DowVision. Dow Jones Business Information Services, Princeton, NJ; 609-520-7733; http://bis.dowjones.com/dowvision.html. *Circle 489 on reader service card.*

First! Individual Inc., Burlington, MA; 800-766-4224, 617-273-6000; http://www.newspage.com/NEWSPAGE/nptb-individual.html. *Circle 490 on reader service card.*

Hoover. SandPoint Co., Cambridge, MA; 800-775-4442, 617-441-2200; fax: 617-441-2370; http://www.iacnet.com/corporate/over/sandpoint.html. *Circle 491 on reader service card.*

Lexis-Nexis. Reed Elsevier Inc., Miamisburg, OH; 800-227-4908, 513-859-1608; http://www.lexis-nexis.com. *Circle 492 on reader service card.*

News Alert. News Alert Inc., New York, NY; 800-501-6396, 212-843-6060; http://www.newsalert.com. *Circle 493 on reader service card.*

NewsEdge. Desktop Data Inc., Waltham, MA; 800-255-3343, 617-672-2400; fax, 617-890-1565. *Circle 494 on reader service card.*

Relevant Personal Edition. Ensemble Information Services, San Rafael, CA; 415-472-8400, http://www.ensemble.com. *Circle 495 on reader service card.*

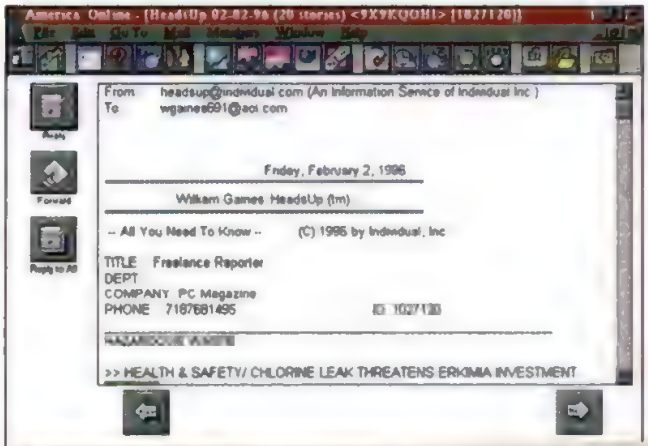
Reuters Business Alert. Reuters Ltd., New York, NY; 800-383-6335, 212-603-3850; http://bizinfo.reuters.com. *Circle 496 on reader service card.*

which is limited to about 60 sources.

Once your topics have been set up, Individual delivers abstracts every morning to your e-mail box or fax machine.

We were able to find topics on our test that provided us with information that compared favorably with the other services. Individual's proprietary technology for gleaning articles from its many sources eliminated such problems as duplicate stories from the same source, thereby reducing in-box clutter. Some of the other services we tested for this evaluation lack this convenient capability.

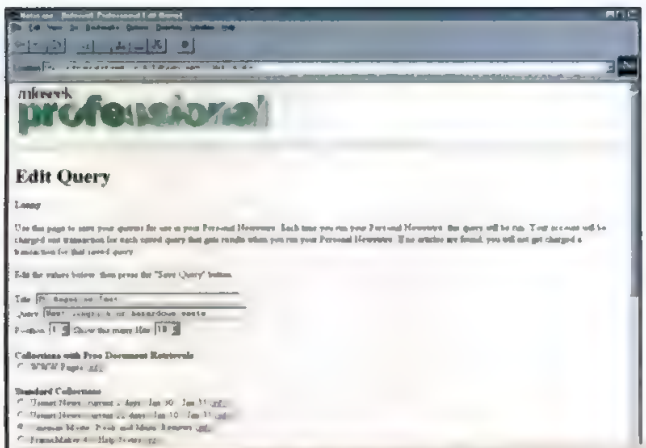
Individual draws from its experience with high-end services (see the sidebar "Custom News for the Corporate Site") to make HeadsUp a strong contender



In one e-mail message, HeadsUp delivers briefs on all the articles that match your personal profile.

SUITABILITY TO TASK	HeadsUp
Ease of setup	Good
Customizability	Excellent
Quality of delivery	Good

TOPIC STRENGTH	
U S news	★★
World news	★★
Business	★★★
Sports	★
Arts & entertainment	★
Technology	★★



InfoSeek Professional lets you edit your Personal Newswire queries in this form. You choose a collection of news sources using option buttons.

SUITABILITY TO TASK	Infoseek Professional
Ease of setup	Good
Customizability	Fair
Quality of delivery	Good
TOPIC STRENGTH	
U.S. news	★★
World news	★★★
Business	★
Sports	★★
Arts & entertainment	★
Technology	★★★

among services we evaluated. And the personal support and attention provided by Individual's staff is a welcome bonus. Although pricier than many of the other services reviewed here, HeadsUp delivers news that's on target.—*TP*

HeadsUp. List price: $29.95 a month including 5 full-text retrievals, plus $2.97 per full-text article. Individual Inc., Burlington, MA; 800-414-1000, 617-273-6000; fax, 800-417-1000; http://www.newspage.com/NEWSPAGE/nptb-individual.html. *Circle 478 on reader service card.*

Infoseek Corp.

Infoseek Professional

This Web-based news-searching tool combines solid sources, natural-language searching, and a great price. It's a subscription version of the popular Infoseek Internet search service with a Personal Newswire feature that lets you name and save searches for access whenever you log on to the site.

To get started with Infoseek, you register a user ID, a password, and a payment method. For $4.95 per month, you get 50 transactions, usually enough for a useful Personal Newswire. After that, each query costs 10 cents. This basic plan gets you standard sources including AP, BusinessWire, Newsbytes, and Reuters Business Report, as well as more-specialized and Internet collections. Premium sources, such as Edge, Hoover's Company Profiles, and SoftBase, carry additional subscription fees.

Searching involves choosing a source collection and entering a query. Infoseek claims you can search using plain English sentences; it doesn't support Boolean operators or wild cards. Simplified proximity searching is possible with quotation marks and brackets, and you can specify date limitations for the articles retrieved.

Most of our simple searches met with success, especially after we consulted the extensive online tips on how to search, but our attempts at natural language searching (for example, "What's happening in Bosnia") yielded either no articles or inappropriate ones.

To make a personal news service useful, you need to save searches for repeat use. This is where Personal Newswire comes in. To set up your Personal Newswire, you simply run a query. The top link on the results page is Save Query in my Personal Newswire; when you click on it, you're prompted for a title for the query, any changes you want to make to it, and its position on your Personal Newswire page.

Article headlines in the Personal Newswire table of contents are organized in relevance order. Within the articles, the search terms are highlighted.

Web surfers will find Infoseek Professional a good fit. Access to a wide range of sources including other Web sites and newsgroups helps keep you on top of the Internet. At $4.95 a month, Infoseek is a bargain.—*William Gaines*

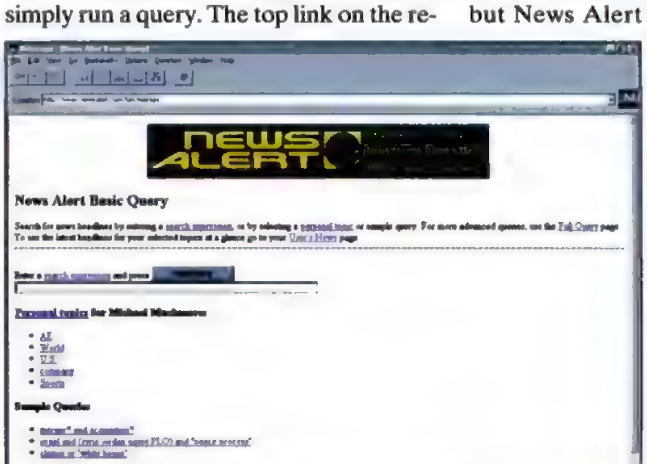
Infoseek Professional. List price: $4.95 with 50 transactions per month; additional transactions, 10 cents each. Infoseek Corp., Santa Clara, CA; 800-781-4636, 408-567-2700; fax, 408-986-1889; http://www.infoseek .com. *Circle 479 on reader service card.*

News Alert Inc.

Internet News Alert

A Web-based news-searching service that allows you to set up a personal topic page, Internet News Alert comes from a company that specializes in creating custom news feeds for businesses.

News Alert's news sources are heavily skewed toward business, political, and public relations news wires such as BusinessWire, PC Quotes, and U.S. Newswire. Major services like AP, Reuters, and UPI are notably absent, but News Alert does offer Sports Net-



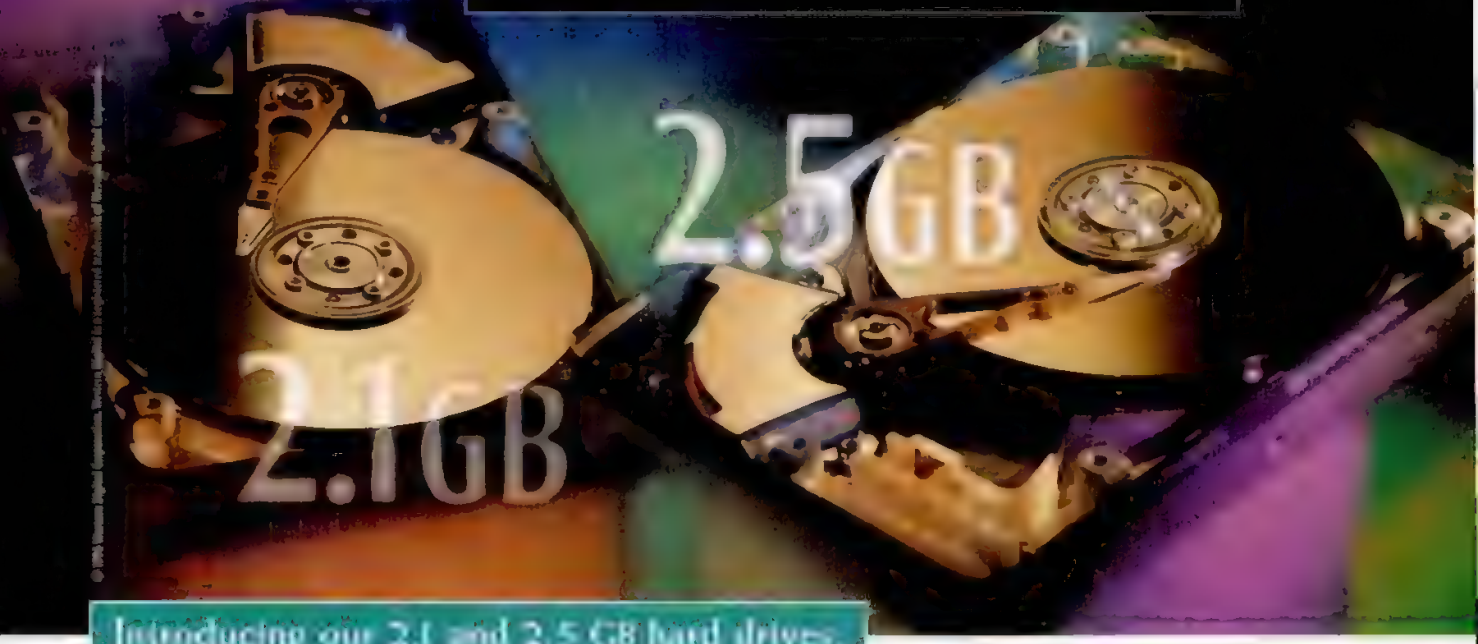
With Internet News Alert, you set up search topics to save in this Web form. You can then choose which ones you want included on your User's News page.

SUITABILITY TO TASK	Internet News Alert
Ease of setup	Excellent
Customizability	Good
Quality of delivery	Good
TOPIC STRENGTH	
U.S news	★★
World news	★★★
Business	★★★
Sports	★★
Arts & entertainment	★
Technology	★★★

Drivers' Ed

CHAPTER 6:

quantity or quality? yes.



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Games education	100-400 MB
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MULTIMEDIA AND INTERNET	
Sound - 30-40 min. high fidelity	225-450 MB
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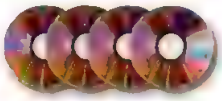

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work and plans to add more general coverage. The basic service, which includes headlines from limited sources and delayed financial quotes, is free, but you pay $1.95 for an article's full text after one full-text retrieval per source per day. For $3.95 a month, the Executive News option gives you headlines, quotes, three full-text retrievals, and selected reports.

On Internet News Alert's topic setup page, you can create five named topics and enter a search expression for each. The ten most recent headlines that match your search criteria are then displayed on your personal news page. Internet News Alert's searching tools include Boolean operators and wild cards for text strings. You can submit your saved search topics at any time or access your User's News screen from a link at the bottom of any Internet News Alert page to get the top ten stories for all your topics.

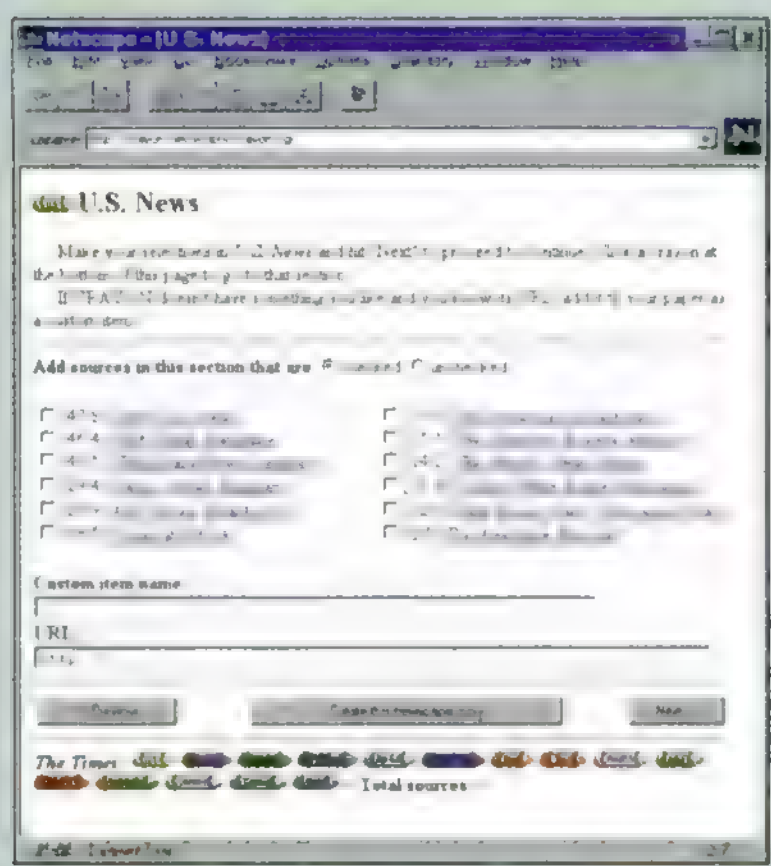
Clicking on a topic displays a summary page that shows ten relevance-ranked stories with news source, dateline, and a summary headline for each. A check box next to each story lets you select multiple articles to preview. A simple button click then generates a browsable preview page for all the stories you've marked. You can also view the full text of a story by clicking

News Link Web Pages: A Useful, Free Alternative

By Michael W. Muchmore

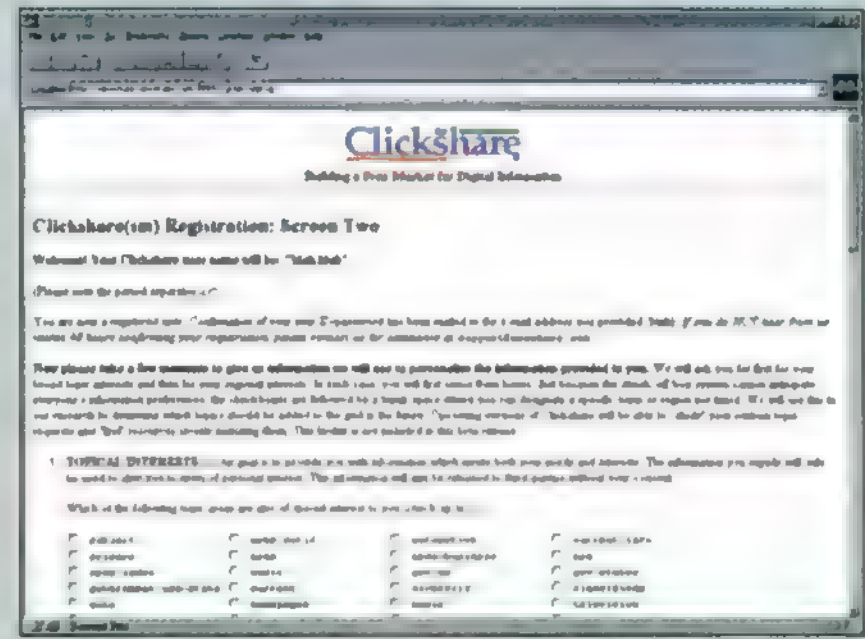
Where full-fledged news sites pipe news content to you directly, personal news pages let you build pages with links to external news sites. Sites typically let you choose from a broad selection of news links organized by category. Best of all, most are free.

Originally a Bucknell University student project, **Crayon** (create your own newspaper: *http://crayon. net*) has recently been upgraded with many additional news links and a streamlined interface. You build your Crayon news page by checking off the news sources you want in a series of forms organized by topic. After you've specified your news sources, you can arrange them in any order you like. Crayon then generates your page, which you save to your hard disk as an HTML file. To get the latest news, you load the page and click on any link.



One of Crayon's source selection forms.

Crayon offers a list of over 250 sources to choose from; they cover world, US, and local news, politics, editorial opinion, weather, business, technology, health, entertainment, sports, and even comics. You can also add links that aren't on the list. Crayon and all of the news sources it accesses are free. But what you get is really valuable, as thousands of hits a day prove.



Clickshare's topic setup is somewhat confusing.

Another free service with roots in academia is **SIFT** (Stanford Information Filtering Tool: *http:// sift .stanford .edu*) provided by the Stanford University's Digital Library Project. This service gets its information entirely from Internet newsgroups. After you register with SIFT by providing an e-mail address and a password, you fill out a simple form with two text boxes: one for your topic word and another for words to avoid. You can add as many topics as you like with subsequent forms. When you've specified all of your topics, you can read your personalized Web page, which arranges all the day's newsgroup submissions in groups that correspond to your topics. It's a fact of newsgroup life that much of what you end up with is irrelevant. But some information is valuable, and this is a good way to find out what people with common interests are thinking about.

The **Microsoft Network home page** (*http://www.msn.com*) lets you customize the page to your individual taste. You can include six URLs of any kind, an Internet search tool (such as Yahoo), up to seven stock ticker symbols to track, six major U.S. sports categories, Reuters/ Excite news bulletins, computing news from Ziff-Davis, TV listings for your area, local weather, and ski reports.

Clickshare Corp. (*http://www .newshare.com/*) offers **Your Personal Newshare,** a customized Web page maintained on Clickshare's server. This way, Clickshare can update your topics of interest whenever newer sources come along. Clickshare's registration involves supplying three pages of demographic information and choosing topics from a large, disorganized list. One option lets you keep your demographic information private and filter out advertising.

SUMMARY OF FEATURES

Online News Feeds

■ YES ■ NO

Products listed in alphabetical order	Custom Clips	EyeQ	FarCast	fishWrap	HeadsUp	Infoseek Professional	Internet News Alert
Price	$15.00 per folder each month, plus $1.50 per 1,000 characters of text	$39.00 per month, $15.00 per folder, $3.00 per full-text article	$9.95 per month	Free	$29.95 per month for five full-text articles; $2.97 per additional article	$4.95 per month for 50 queries and retrievals; $0.50 per additional transaction	Basic Service: Free; Executive News: $3.95 per month, plus $1.95 per full-text article
Sources							
Financial/general news wires	■■	■■	■■	■■	■■	■■	■■
Newspapers/Magazines	■■	■■	■■	■■	■■	■■	■■
Broadcast transcripts	■	■	■	■	■	■	■
Industry/trade journals	■■	■■	■■	■■	■■	■■	■■
Specifiable News Content							
Local/state/international news	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Individual companies/industries	■■	■■	■■	■■	■■	■■	■■
Stocks/Bonds	■■	■■	■■	■■	■■	■■	■■
Mutual funds/Futures	■■	■■	■■	■■	■■	■■	■■
Sports/Arts and entertainment/Technology	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Customization							
Choose from topic lists	■	■	■	■	■	■	■
Number of topics	N/A	N/A	95	70	2,400	N/A	N/A
Specify search terms	■	■	■	■	■	■	■
Search by date/source	■■	■■	■■	■■	■■	■■	■■
Supports Boolean operators/proximity searches	■■	■■	■■	■■	■■	■■	■■
Delivery							
Provides article summaries	■	■	■	■	■	■	■
Ranks articles by relevance	■	■	■	■	■	■	■
Updates on request	■	■	■	■	■	■	■
Automatic delivery	■	■	■	■	■	■	■
Delivers via fax/e-mail/updated Web site	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Delivers via custom software	■	■	■	■	■	■	■
Maximum connection speed	Limited by access provider	19.2 Kbps	N/A	N/A	N/A	N/A	N/A
Default update frequency	Continually	Continually	Continually	Continually	Daily	3 or 4 times daily	Continually
User can schedule times of updates	■	■	■	■	■	■	■
Multimedia content: images/sound/video	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Support							
Printed documentation/Online help available	■■	■■	■■	■■	■■	■■	■■
Toll-free telephone support	■	■	■	■	■	■	■

N/A—Not applicable: The product does not have this feature.

on an article headline; your keywords are shown in boldface in the text.

Our test topics immediately produced many hits. As with many other services, we got some irrelevant articles simply because they contained a given keyword.

Internet News Alert is a useful, well-designed customizable news service. It offers immediate results and a clear interface.—*MWM*

Internet News Alert. List price: Basic headline searches, free; Executive News, $3.95 per month; each additional full-text retrieval, $1.95. News Alert Inc., New York, NY; 212-843-6060; fax, 212-889-5281; http://www.newsalert.com/. *Circle 480 on reader service card.*

PointCast Inc.

Journalist

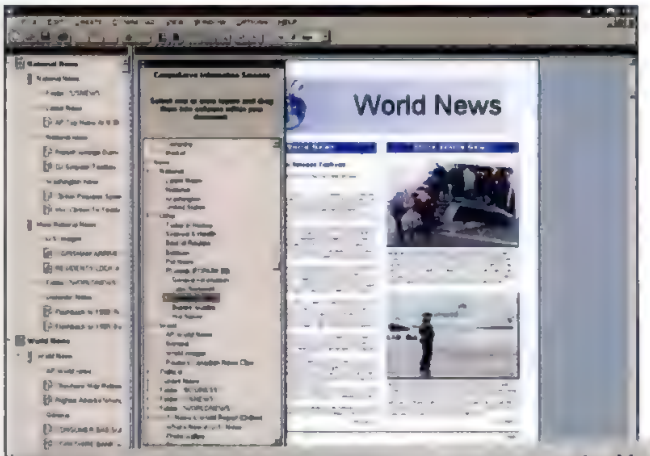
Journalist 3.0, from PointCast, is a Windows front end to CompuServe that builds an attractive news magazine based on sources found in the CompuServe service. Unfortunately, it offers few ways to filter content, and we found the software hard to use. Beyond the $19.95 download charge, the only costs for using Journalist are standard CompuServe connect charges.

Journalist lets you choose your news from predefined topics. It dials up CompuServe to retrieve the data, which it composes into a magazine-like electronic document that includes graphics and charts.

With almost all of the news sources, you can filter information only by choosing topics. The only significant exception is CompuServe's Executive News Service (ENS), an extra-cost service. When we used ENS, Journalist let us set up as many as seven keyword filters in each of three sections. For each section, we could also choose from among the list of available wire services, including numerous AP, Reuters, and UPI wires. You can also request stock data by company.

In ENS, our test searches turned up a healthy number of hits, but it was more difficult to determine how much of what we wanted was available in Journalist's predefined topic areas. A find command wasn't available, so we couldn't look for specific terms we wanted.

Journalist	NewsGrid	NewsHound	Personal Journal	Profound
$19 95 for start-up software, plus CompuServe online time	$8 95 per month for 5 hours; $3.50 each additional hour	$4 95 per month per folder of 5 profiles	$12 95 per month for one daily update, $0 50 per additional update	$19 95 per month
62	80	N/A	N/A	More than 1,500
Limited by service provider	28 8 Kbps	N/A	Limited by service provider	14.4 Kbps
Continually	Continually	Hourly	Every 15 minutes	Continually



In PointCast's Journalist, you choose from a list of general subjects and specific areas on CompuServe to produce a personalized news magazine.

SUITABILITY TO TASK	Journalist
Ease of setup	Fair
Customizability	Fair
Quality of delivery	Fair
TOPIC STRENGTH	
U.S. news	★★★
World news	★★★
Business	★★★
Sports	★
Arts & entertainment	★★★
Technology	★★★

Some of the sections had better content than others. The business news and computer news sections, for example, were quite strong, but the arts and entertainment sections were dominated by soap opera summaries.

Journalist is based on code from the now-antiquated WinCIM 1.3 (WinCIM is CompuServe's Windows software). It lacks support for connecting to CompuServe via the Internet and other network connections, as well as for a number of high-speed modems. But we found it easy to set up the communications sessions for supported modems.

In addition to the $19.95 download charge, you also incur CompuServe online charges, which vary widely by level of service and connection speed.

If your filtering needs are simple and you want mainstream news, Journalist will do the job, but the product could be improved significantly by better filtering and communications.—*LS*

Journalist 3.0. List price: $19.95. PointCast Inc. Cupertino, CA; 408-253-0894; fax, 408-253-1062; http://www.pointcast .com/. *Circle 481 on reader service card.*

The Transom

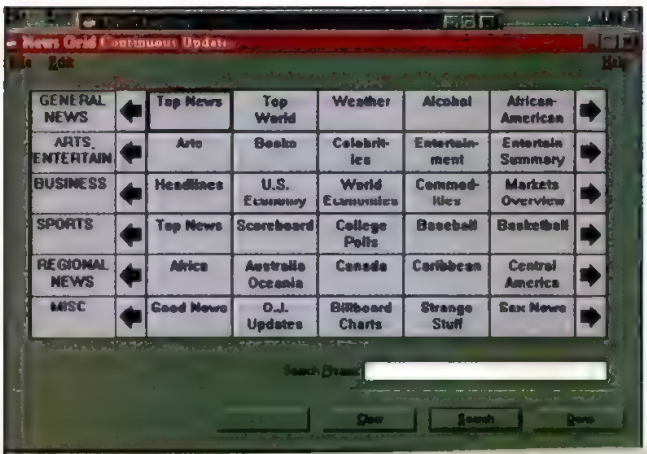
NewsGrid

NewsGrid, part of The Transom online service from Reach Networks, offers simple access to thousands of daily articles through a friendly and intuitive proprietary interface. Priced at $8.95 per month (includes the first 5 hours of connect time; additional time costs $3.50 per hour), it's a good value compared with other custom-interface services.

One of dozens of Transom online services, NewsGrid is accessed with Transom's proprietary Windows 3.1 software (we tested it successfully under Windows 95). Transom offers 28.8-Kbps local access from anywhere in the U.S.; local access is also available in many foreign cities though often at slower connection speeds.

Because it is an interactive service, NewsGrid delivers results immediately, rather than posting search results via e-mail. As its name suggests, the service emphasizes news and includes sources such as AP Newsbytes, BusinessWire, Reuters, SportsTicker, and *USA Today*.

NewsGrid's search interface presents a



NewsGrid presents a grid of buttons, which you scroll and select. You can then add a search phrase to refine your topic further.

SUITABILITY TO TASK	
NewsGrid	
Ease of setup	Fair
Customizability	Good
Quality of delivery	Fair

TOPIC STRENGTH	
U.S. news	★★★
World news	★★★
Business	★★★
Sports	★★
Arts & entertainment	★★
Technology	★★

topic matrix with scrollable lists of subjects reminiscent of Jeopardy, the game show. To find articles relating to Mexico, for example, you scroll through the regional row of topic buttons until you find the Mexico button, then click on it to launch the search. Results are returned as a series of headlines. Double-clicking the mouse cursor on a headline instantly brings up the full text at no additional charge. You can also create custom queries using a simplified set of Boolean operators. Queries can be saved and rerun as often as you like.

On our tests, NewsGrid delivered a wealth of results, but not before we'd done a considerable amount of experimentation. Using the basic topics interface often yielded duplicate or irrelevant stories; searches based on custom queries, however, produced far more accurate results.

Besides creating and saving NewsGrid searches, you can also create a business portfolio that lets you track stock prices (with the customary 15-minute delay) and get an array of daily market and economic information.

NewsGrid gets about 1,600 news stories a day; the stories remain online anywhere from one day to three months, depending on the feed. If you're interested in up-to-the-minute information and don't mind learning its interactive search tools, NewsGrid offers good value for its low price.—*WG*

NewsGrid. List price: $8.95 per month, plus $3.50 per hour after the first 5 hours. The Transom, New York, NY; 800-475-9689, 212-274-0444; fax, 212-274-0695; http://www.transom.com. *Circle 482 on reader service card.*

Mercury Center

NewsHound

Here's a dog that's really paper-trained," boasts Mercury Center about its customizable news service. NewsHound combines strong customization with a low price ($4.95 per month for 5 profiles). It sniffs out about 2,000 articles daily from sources such as AP, Business Wire, and over 60 newspapers, including the *Chicago Tribune,* the *Philadelphia Inquirer,* and, of course, its home base, *The San Jose Mercury News.* Like Farcast, the service uses Internet e-mail both to deliver your custom news and to set up daily queries.

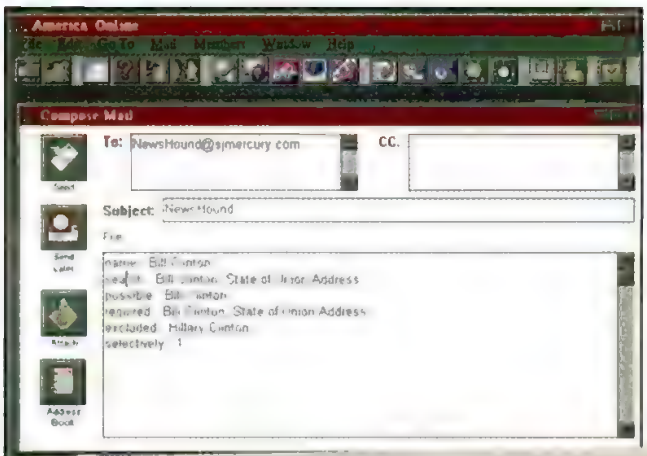
NewsHound is one of the lowest-priced services of our test group. The monthly charge brings you five news profiles and unlimited full-text retrieval. You can obtain NewsHound through America Online by entering the keyword "newshound."

NewsHound's Profiles are custom search queries that define your topics. NewsHound uses the Profile to search through the nearly 2,000 new articles it gets a day to extract only those that meet the search criteria. You can either use your stored Profile queries or perform ad hoc searches.

You create, modify, or remove NewsHound Profiles by sending a properly formatted e-mail message. NewsHound does not use Boolean terms; it claims that you'll get better results with its system of specifying "possible," "required," and "excluded" terms. We found that this query system did a good job of eliminating irrelevant articles, though we're not convinced that there's nothing Boolean about it.

In testing, NewsHound delivered an impressive array of pertinent articles, but it took a bit of tweaking to fine-tune our results. Articles are delivered in full text, and each one appears in a separate e-mail message with the headline as the subject. You have to open the article to see which Profile gleaned it for you though; we would have preferred the Profile name in the subject line.

Solid news, full-text articles and low cost make this NewsHound a prime contender among the services we evaluated.



NewsHound accepts search requests for your Profiles in this format. Selectivity lets you specify the relevance of articles you want.

SUITABILITY TO TASK	
NewsHound	
Ease of setup	Good
Customizability	Excellent
Quality of delivery	Excellent

TOPIC STRENGTH	
U.S. news	★★★
World news	★★★
Business	★★★
Sports	★★★
Arts & entertainment	★★★
Technology	★★★

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Sneak Preview: IBM's infoSage

By Larry Seltzer

We were disappointed, but infoSage, IBM's news service, wasn't ready for testing in time for this evaluation. Based on a prerelease version of the final software, which should be shipping as you read this, infoSage looks like just the sort of product a demanding news junkie would want.

With infoSage, you define in an off-line Windows program the stories and information you want and the sources from which they should be obtained. This profile editor then dials up a server and uploads your profile. You can also choose in the profile editor whether you want your information delivered to a personal Web page on IBM's server or sent to your e-mail account.

The profile editor first guides you through the process of selecting topics in its business news (which also includes general news). You drill down in your topic selection in a folder hierarchy, then choose the type of information you want on the topic. Some topics have predefined types, such as "mergers and acquisitions," but you can add your own keywords. You can then repeat the process in a separate Arts, Sports and Leisure hierarchy. You can also specify stock quotes. Then you send the topics to the system.

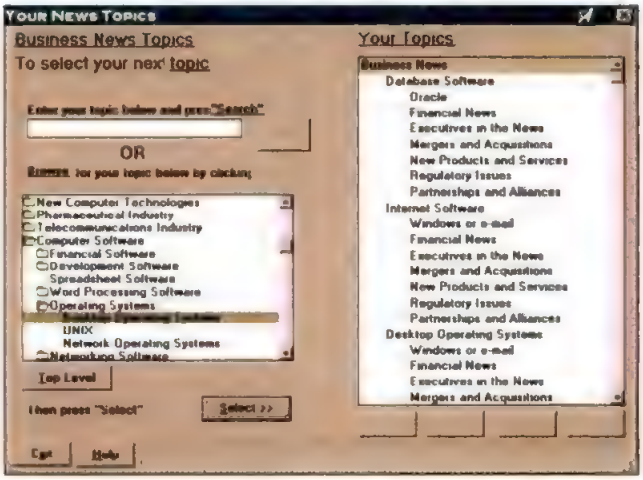
Unless you want to change your profile, the rest is handled in your Web browser or e-mail client. Twice a day, infoSage updates the database from which it creates your personal Web page or sends your stories to your e-mail account. The retrieved articles contain links to stories with further details and company profiles, which you can retrieve at additional cost.

The content list for infoSage looks impressive, with a hefty list of business and general news services, such as FedNet, Reuters, and UPI, as well as a decent selection of international news providers, including Africa News Service, South American Business Information and Xinhua News Agency, the official state news service of China. Filling out the list of sources, which IBM expects to expand further, are entertainment services, The Sports Network, and Ziff-Wire.

During an initial trial period, infoSage will be free with subscribers getting up to 30 messages a day; but the links to additional information will carry a price tag. After the trial period, the service will cost $24.95 per month.

If IBM follows through on infoSage's promise, it offer strong competition for EyeQ, Profound, and the other heavy-duty but affordable business news services reviewed here.

infoSage. List price: $24.95 per month. IBM Corp., White Plains, NY; 800-210-5857; http://www.infosage.ibm.com. *Circle 497 on reader service card.*



InfoSage presents you with a hierarchical list of industries to choose from and lets you add search terms.

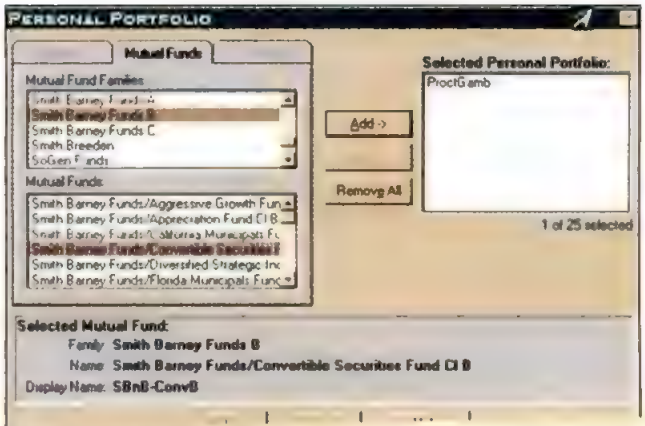
While not everyone will be comfortable with its e-mail–based Profile configuration, the results are worth any hassles.—*TP*

NewsHound. List price: $4.95 per month for five profiles. Mercury Center, San Jose, CA; 800-818-6397, 408-297-8495; fax, 408-271-3718; http://www.sjmercury.com/ hound. *Circle 483 on reader service card.*

Dow Jones Business Information Services

Personal Journal

If you love *The Wall Street Journal,* you'll love Personal Journal, an online incarnation of the world's most famous business newspaper. But if you love *The Wall Street Journal,* you probably read it



Personal Journal lets you pick stocks, mutual funds and company news to track each time you call. There is little else in the program to customize.

SUITABILITY TO TASK

Personal Journal

Ease of setup	Excellent
Customizability	Poor
Quality of delivery	Good

TOPIC STRENGTH

U S news	★★★
World news	★★
Business	★★★
Sports	★
Arts & entertainment	★
Technology	★★

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HDD	810MB	1.3GB	1.3GB	1.3 GB
DISPLAY	11.3" Dual Scan Color	11.3" Active Matrix Color	11.3" Active Matrix Color	11.3" Active Matrix Color
BATTERY	NiMH	Lithium Ion	Lithium Ion	Lithium Ion
WARRANTY	3 year	3 year	3 year	3 year
PRICE	**$2,999**	**$3,499**	**$3,999**	**$4,499**
BUSINESS LEASE	$109 per month	$115 per month	$131 per month	$148 per month

SENS 800 PENTIUM® PROCESSOR	75 MHZ	75 MHZ	90 MHZ
RAM	8MB	8MB	8MB
HDD	520MB	810MB	1.3GB
DISPLAY	10.4" Dual Scan Color	10.4" Active Matrix Color	10.4" Active Matrix Color
WARRANTY	3 year	3 year	3 year
PRICE	**$1,899**	**$2,499**	**$2,999**
BUSINESS LEASE	$69 per month	$91 per month	$109 per month

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already, making some of the best parts of Personal Journal redundant.

In addition to selected stories from the daily *Journal*, Personal Journal includes general news from AP, sports news from ESPN, business news from Dow Jones, and reports from AccuWeather updated throughout the day. We were also able to track specific stocks and mutual funds in a portfolio that we defined.

At $12.95 a month, Personal Journal is quite affordable. The price covers one update per day; additional updates cost 50 cents each.

The proprietary Personal Journal software is well designed. Six sections are available through tabs on the right of the window: Front Page (*Journal* stories); This Just In (Dow Jones business and AP World Wide news wires); Markets (currency and bond data, stock indexes, and market analysis); Personal Portfolio (prices of as many as 25 selected stocks and mutual funds); Sports (an ESPN wire); and Weather.

Some of the configuration screens, such as the Portfolio setup screen, were not as flexible as we would have liked, but the software was easy to use. Configuring the communications settings is a breeze. The connection is through Sprintnet in the contiguous 48 states and through Tymnet elsewhere. You must choose which network to use, but connection details are handled behind the scenes.

Personal Journal's biggest downside is that its tools for customizing news are limited. Your sole choices are to search on company name in the Front Page and Personal Portfolio sections, and to add specific sections of the *Journal*, such as "Heard On The Street."

Should you get Personal Journal if you already read the newspaper? On the positive side, there's the added news and stock information updated throughout the day. There's also the ability to search on company name, although the print version's Company Index does that too. The downside includes limited customization and the lack of both raw financial data found in the *Journal*'s print version and the libraries of historical data available in some other services. But if your news needs aren't heavy-duty or very specialized, Personal Journal might be just right for you.—*LS*

Personal Journal. List price: $12.95 per month, with one daily update; 50 cents each additional update. Dow Jones Business Information Services, Princeton, NJ; 800-271-9382, 609-520-4000; http://bis.dowjones.com/pj.html. *Circle 484 on reader service card.*

Profound Inc.

Profound

PC MAGAZINE EDITORS' CHOICE

With innovative Microsoft Windows–based software that makes use of Adobe Acrobat to display documents in their original format, Profound is a powerhouse of business and general information, and it's relatively easy to set up for personal news delivery. It counts such heavyweights as AP, Knight-Ridder, and Reuters among its news sources. And even with all that power and ease, it costs a reasonable $19.95 a month, with a $6.95 per hour connect charge.

As with NewsGrid and EyeQ, you dial into a proprietary service, then create queries and read results online in the provided software. Profound's search-phrase parser was one of the best we saw, yielding accurate results after only minor tweaking.

Profound maintains databases of all its documents. They are indexed by market sector, company name, country, words in headlines, publisher, date, and scope (a hierarchy of subjects ranging from abortion to zoning). You use a drill-down approach to create your queries. Start by selecting a database, such as business or world news, then narrow the search by market sector, company name, country, date, or free-text search terms.

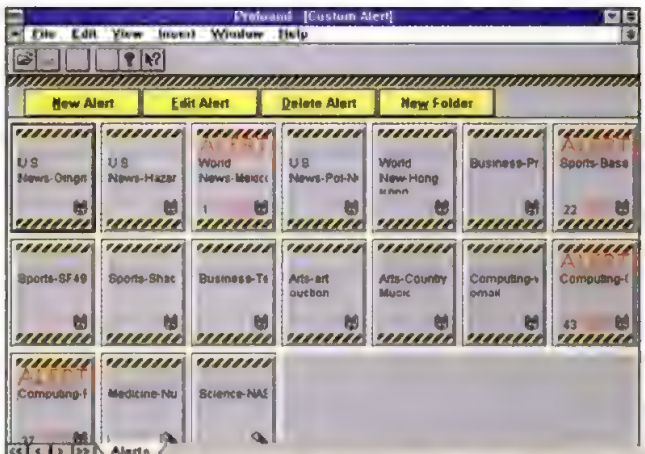
Broader and Narrower option buttons in the Navigator, which you use to select the search criteria, offer help in adjusting your search. Profound has two searching methods: AutoSearch is the simpler one, lacking the Scope and Title text criteria of the more complete WorldSearch. Profound is one of just a few products that let you refine your search to this extent.

Queries can be saved as Custom Alerts, which let you define how often the sources should be searched, daily or weekly.

Most of our test searches took only a few seconds, but sometimes we had to wait for the download meter at the bottom of Profound's window. We received little irrelevant information: The articles were well chosen from a vast number of sources. Headlines are displayed in a chronological list. And, as in several other services we reviewed, search terms are highlighted in full-text articles, which cost an extra $1.50 each to download.

Ease-of-use, powerful indexed searching, comprehensive news sources, and WYSIWYG document display make Profound a good choice for the demanding news hunter.—*TP* □

Profound. List price: $19.95 per month, $6.95-per-hour connect charge. Profound Inc., New York, NY; 800-270-9896, 212-750-6900; fax, 212-750-0660; http://www.profound.com. *Circle 485 on reader service card.*



Profound's point and click interface lets you select categories to search on. Save search queries as Alerts to be notified when updates arrive.

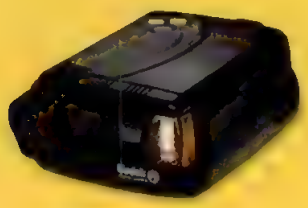
SUITABILITY TO TASK

Profound	
Ease of setup	Excellent
Customizability	Excellent
Quality of delivery	Excellent

TOPIC STRENGTH

U.S news	★★★★
World news	★★★
Business	★★★
Sports	★★★
Arts & entertainment	★★
Technology	★★★★

We offer unsurpassed digital image quality. (And by the looks of it, quantity too.)



The DCS 465 digital camera back is compatible with medium format HASSELBLAD and MAMIYA and 4 x 5 view cameras. It offers 6 [illegible] and works

The DCS 460 digital camera offers 6 million pixel resolution, and a high sensitivity for shadow and detail. Our premier digital camera.

The DC 40 camera offers a choice of snapshot and high resolution pictures. [illegible]

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While *Kodak Digital Science*™ cameras vary from high-end to point-and-shoot, what they share are the very things that make them *Kodak* cameras. A commitment to preserve image quality through every stage of the digital process. And the technology to make it so.

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To find out more about our full line of *Kodak Digital Science* cameras, call 1-800-322-2177 ext. 605 in the U.S., 1-800-465-6325 ext. 36100 in Canada. Or visit us on the World Wide Web at http://www.kodak.com/

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AcerView 98i
(19.7" viewable image)

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Create Your Own CD: Premastering Tools

Third-party packages offer solid core features and support for special formats.

CREATE YOUR OWN CD

By Jon Hill

Not long ago, an inexpensive CD recorder meant a $5,000 to $10,000 investment, and most premastering software, whether Unix- or DOS-based, looked as though it had been designed to ward off casual attempts to burn a CD.

Today, hardware is far more accessible, but software still has a way to go. As indicated in this issue's review of CD-R devices ("Create Your Own CD: CD-R Drives"), you can easily wind up with a bundled premastering package that's difficult to use, short on features, and a poor performer to boot.

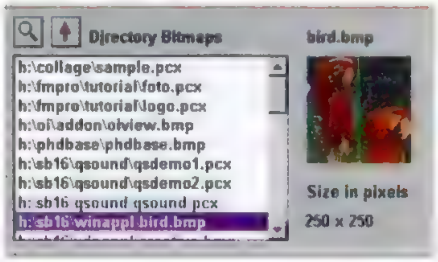
A third-party premastering package for your recorder can provide a solution, but here, too, caution is advisable. The wrong choice can leave you with an upgrade that costs thousands of dollars, is nearly impossible to work with, and offers poorer functionality than some software bundled for free.

REASONS TO SWITCH

Still, there are a number of good packages to pick from and several good reasons to upgrade. Some vendors merely slip "lite," feature-

ILLUSTRATION BY HAYES HENDERSON

IN THIS SECTION



Organizing digital pictures is easy with PicAlbum, this issue's utility.

TUTOR How can you verify that a file you receive over a modem or Internet connection is really from the person you think it's from? And how can you be sure that the file is intact? This issue's Tutor column answers these questions, explaining checksums, cyclic redundancy checks, public-key encryption, and digital signatures along the way. *page 237*

POWER PROGRAMMING OLE Automation Collections provide a standard way for programmers to store and retrieve data elements and objects. Starting with a linked-list object created in Visual C++ for use in Visual Basic, we use the new 32-bit version of Borland's Delphi to create an Automation object that can be accessed via the Automation Collection interface. *page 249*

UTILITIES Now there's a way to organize all those bitmap files you have stored all over your hard disk. PicAlbum lets you create photo albums that group similar images together—without forcing you to change the image file's location on your disk. *page 267*

ALSO IN THIS ISSUE In PC Solutions we tell you how to clear the recent-files list in a few different Windows applications, give you an updated way to disassemble .COM files, and explain the difference between hard disk caches and L2 caches. You'll also learn the safe way to delete .TMP files from your hard disk without jeopardizing Windows performance, how to save and close multiple documents in WordPerfect 6.0, and more. *page 281*

After scanning the car with HP ScanJet 4c, we added and manipulated Corel Professional Photos using Corel PHOTO-PAINT 5 to create this exciting image

Together Corel PHOTO-PAINT 5 and the HP ScanJet 4c Color/Grayscale scanner can help you unleash the power of your imagination in creating impressive documents, flyers and brochures. Now when you purchase the HP ScanJet 4c scanner you will also receive Corel PHOTO-PAINT 5.

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- Intuitive user interface: fun and easy to use

Corel PHOTO-PAINT NUMBER ONE in IMAGE-EDITING

Product	S.L.P. (US$)	Overall weighted score
Corel PHOTO-PAINT 5 Plus	$249	44
Micrograph Picture Publisher 5.0	$595	42
Adobe PhotoShop 3.0	$895	39
Fractal Design Painter 3	$499	38

PC World Best Buy Award, April 1995

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CD CREATE YOUR OWN

versions of their software into hardware bundles. Other packages, squarely targeted at mass-market applications such as hard disk backup, hide parameters from the end user in order to present a simple face and are thus unsuited to more demanding tasks. It's also not uncommon to find that some parts of your bundled software simply don't work or are so hard to use that you'd rather switch than fight.

There's often a large gap between a claimed feature and the real world. Support for hybrid CDs (PC/Mac/Unix), CD-I (Green Book), and Video-CDs (White Book) is generally quite poor. A third-party package is often a necessity for those who need to create these special formats. Another incentive to upgrade is that while several CD-R hardware vendors support simultaneous writing to more than one device (letting you turn a 1-off into a 2- or even 32-off), bundled software rarely does so.

IN THIS STORY

This story looks at four third-party premastering packages that offer features your bundled software probably lacks.

The first three—Philips Media OptImage's CD-It!All, Creative Digital Research's CDR Publisher, and Optical Media's QuickTopix—are general-purpose packages that also offer a particular specialty that may be vital in certain projects. CDR Publisher supports the creation of multiplatform CDs (with DOS, Macintosh, and Unix partitions), QuickTopix provides strong Mac support, and CD-It!All supports Video-CD creation. The fourth package, Philips Media OptImage's Video CD 2.0 Toolkit, is a video specialty tool that lets you create a CD formatted for CD-I and playable on CD XA hardware.

Although the first three of the four packages will answer most of the basic needs not addressed by the software included with your CD-R drive, they are not the only good tools for performing basic tasks. The best of the bundled packages are on a par with the core functions of the software we review here. Accordingly, we'll also briefly discuss some general-purpose packages that may suit your needs.

Unfortunately, we were unable to review CeQuadrat's VideoPack—both it and CeQuadrat's WinOnCD general-purpose premastering software were between revisions during our test period. According to the company, though, the new VideoPack will be able to premaster and burn a CD on its own, without requiring a separate recording package.

LOOKING AT UPGRADES

When selecting an upgrade mastering package, you need to consider a couple of issues right off the bat. First and foremost is device support. For example, if the new HP SureStore CD-Writer 4020i (reviewed in this issue) takes off as expected, all the general-purpose premastering packages will support it eventually, but right now you're stuck with the software that comes in the bundle. Devices that are almost universally supported include the Philips PCD521/522, the Sony CDU920S, and the Yamaha CDE100 and CDR100. Other recorders, including some fairly ubiquitous drives like the JVC XRW2001 and Ricoh RS-9200CD, may or may not be supported.

Next, you need to investigate whether your hardware is capable of supporting the software feature that you wish to exploit. Older drives may not be able to create a true multisession CD (Photo CD). New standards, most conspicuously Microsoft's Enhanced CD (CD Plus) format (tentatively Blue Book), may require firmware upgrades even in currently shipping drives—Sony's CDU920S is one example.

Finally, carefully check your prospective upgrade's system requirements. Some packages require SCSI source devices (CD-ROM readers and hard disks), while others are perfectly happy to use IDE-based peripherals as long as these can provide an acceptable data-transfer rate. If you're planning on creating advanced-format CDs, you'll almost certainly want to maintain enough free disk space to hold several CDs' worth of ISO image files (which can be up to 680MB each), so that you can test an image before you burn a CD-R disk.

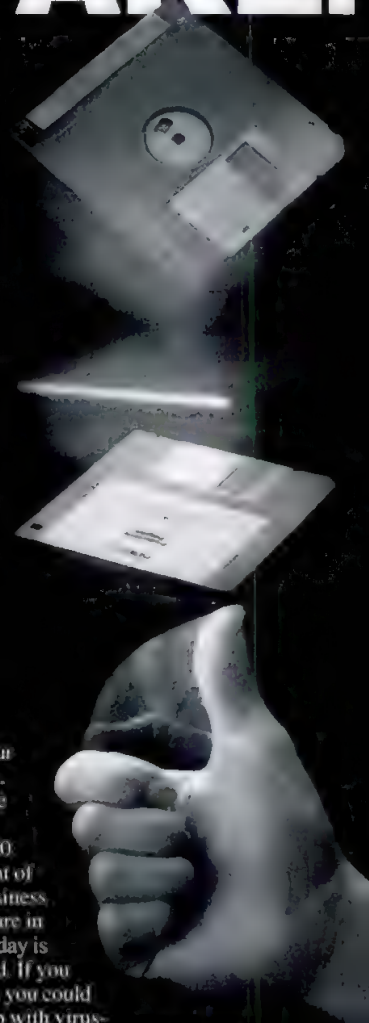
OTHER CHOICES

If you're not happy with the software bundled with your CD-R drive, there are several relatively inexpensive general-purpose alternatives that may be a bit easier to use or more well-rounded. Three of these packages are reviewed here in full. Other packages not included here are Corel CD Creator 2.0; Easy-CD Pro MM 3.0, from Incat; GEAR MM 3.23, from Elektroson; SimpliCD 3.1, from Young Minds; and WinOnCD 2.14, from CeQuadrat.

Several of these packages (Easy-CD Pro, GEAR, and CD Creator) are included as bundled software with some of the CD-R drives reviewed in this issue—we'll discuss them only briefly here—but all are available as stand-alone products that contain broad CD-R device support.

Every one of these packages can perform a core set of premastering tasks, which include creating a physical ISO image and burning a CD from that image. They also provide common support for the CD-ROM, CD-DA, and CD-ROM XA formats. Each of these packages can create Photo CD multisession disks (Orange Book) and, if your hardware supports it, can perform a test run that replicates every

HEADS, IT'S REAL. TAILS, IT'S FAKE.



It's your choice. A little more than 50 percent of all business software in use today is pirated. If you buy it, you could end up with virus-ridden, phony software that has no documentation or product support.

Selling or copying pirated software without authorization is against the law, with severe criminal and civil penalties including imprisonment of up to five years, fines of up to $250,000, or both. If you suspect the sale or use of pirated software, call the BSA Anti-Piracy hotline:

(800) 688-BSA1 (2721)

Business Software Alliance

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CD CREATE YOUR OWN

step of the recording process including writing to the CD—but with the laser turned off so that nothing is actually written to disk.

Premastering capabilities begin to diverge beyond this basic functionality. All claim the ability to write to a CD-R on the fly from a virtual ISO image, but we encountered repeated buffer underruns when we tried to write on the fly using Version 3.23 of GEAR MM for Windows. Gear does not currently dedicate any hard disk space for use as a temporary buffer and so performs poorly on this task. SimpliCD does not support CD-I formats at all, while OptImage's CD-It!All provides the best CD-I support, working directly with the company's MediaMogul Studio Package for the PC. MediaMogul combines CD-I image-creation software with an ISA-based CD-I player that lets you test the image right on your PC.

UNUSUAL TASKS

Tasks that are generally beyond the capabilities of commonly bundled software include the ability to create a cross-platform hybrid disk (PC, Mac, and Unix), an Enhanced CD disk (CD Plus), and Bootable CDs. Easy-CD Pro, GEAR, and QuickTopix can generate PC/Mac hybrid disks but require access to both PC- and Mac-formatted hard disks. CDR Publisher, however, can generate all three types of CDs.

GEAR provides a batch language to automate repetitive operations. CDR Publisher goes a step further: Its optional Developer's Kit lets you create customized CD-R applications that can be integrated with multimedia authoring tools, your own search-and-retrieval software, or any other existing program. Thus, if you've written an automated tape backup procedure, you can convert it to CD-based backup with minimal disruption.

Several of these packages are available across a range of operating systems, but features and capabilities vary among the different platforms. In particular, Windows 95 and Windows NT seem to have thrown developers for a loop. We have concentrated on software compatible with Windows 3.1*x*—it and Apple's Mac OS System 7 generally receive the most robust support—but we've also taken a look at Windows 95 and Windows NT versions where available.

TESTING FOR THIS STORY

We tested the packages reviewed in this story with the same test script and files we used for our CD-R drive reviews. We were able to verify that all the packages supported the same standard formats.

Our main test-bed was a 133-MHz Pentium-based Micron Millennia equipped with 16MB of RAM, a Sound Blaster AWE32 audio card, and two Adaptec SCSI cards: We connected a Plextor 6Plex 6X CD-ROM reader and a 2.2GB Conner CFP2107S hard disk to an Adaptec AHA-2940 PCI card, and a Sony CDR-920S CD-Recorder to its own AHA-1510 ISA card.

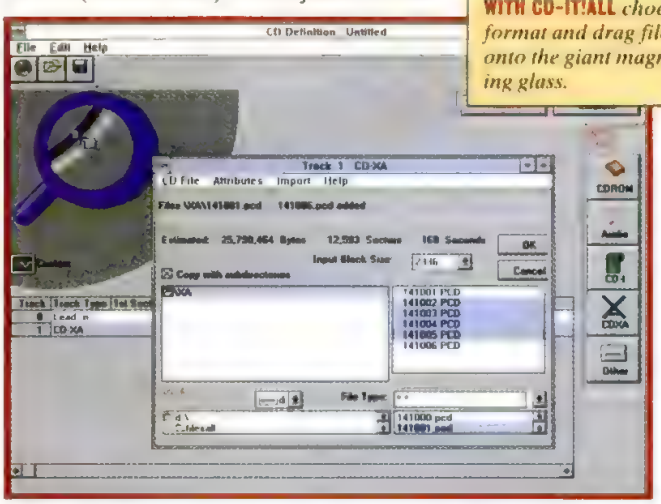
Our Windows 95–based testing took place on a second machine, an unbranded 100-MHz Pentium with an Intel motherboard and AMI PnP BIOS. This was equipped with 16MB of RAM, a Sound Blaster 16 audio card, a 1GB Seagate 31220A IDE hard disk, a Panasonic 2X IDE CD-ROM reader, and both a Quantum ProDrive 1080S hard disk and a Yamaha CDR100 CD-Recorder connected to an Adaptec AHA-1540A SCSI card. The Yamaha CDR100 is an unsupported device under Windows 95, and there are currently no Windows 95 drivers for it. Thus, while it worked perfectly well during our CD-R tests, it was unavailable for use as a CD-ROM reader under Windows 95.

Philips Media OptImage

CD-It!All

ALL REVIEWS BY JON HILL

CD-It!All 1.13 ($999), from Philips Media OptImage, is a versatile, high-end premastering package designed for the multimedia authoring market. It features strong support for CD-I, in particular Video-CD 2.0 (White Book). In conjunction with Philips Media OptImage's own Video-CD 2.0 Toolkit (also reviewed here), CD-It!All can burn Video-CDs right out of the box. The Toolkit is a separate Video-CD–authoring tool that generates the special image and control files Video-CD requires.



WITH CD-IT!ALL *choose a format and drag files onto the giant magnifying glass.*

CD-It!All's Video-CD functionality is not surprising given its heritage. OptImage is a division of Philips Interactive, which created the CD-I and Video-CD standards and is a leading manufacturer of CD-I players. Philips offers a wide range of CD-I–oriented solutions, including authoring software for PCs, Macs, and Sun workstations as well as hardware CD-I emulators that let you create and test CD-I applications directly on a PC or Mac.

EXPERIENCE NECESSARY

Experienced users will appreciate CD-It!All's ability to create custom formats, but most users should stick to the predefined selections. If you're not careful, it's possible to put together a CD Definition that includes mismatched formats, which can result in CD-recorder session failures (caused by lack of firmware support or sessions that are unreadable without customized drivers).

CD-It!All can make virtually any type of CD, but it does not support Mac (HFS) and Unix (Rock Ridge) file systems. You can create Mac Data and Resource forks within an ISO 9660 file system, however.

We were able to back up a SCSI hard disk containing more than 15,000 small and medium-size files at the Yamaha CDR100's top recording speed (4X) on the fly. The software's procedure for creating Photo CD multisession disks is also very straightforward: Simply insert the previously written but not finalized disk, import its CD Definition, and add your new files.

CD-It!All has an advanced graphical interface and a deceptively simple look and feel, but novice users will find that this package gets a bit confusing once they get past the opening screens. This may have something to do with the product's origins. Developed in concert with Dataware Technologies, CD-It!All is essentially identical to Dataware's CD Record, which has roots that reach back into the early days of MS-DOS command line premastering software.

The package installs via a standard Windows Setup routine and features a full uninstall module. To burn a CD, you begin by creating a CD Definition file. Choose File | New and a CD Type window pops up giving you nine options for your CD: CD-ROM, Audio (CD-DA), CD-ROM + Audio (mixed-mode), CD-XA, Video-CD, CD-I/XA Bridge, MMCD, CD-I, and Custom. After you choose a format, another window pops up into which you can drag and drop files from

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CD CREATE YOUR OWN

any SCSI-based source. When you've completed the CD Definition, an emulation facility lets you test your work on a simulated CD drive. Note that this works only for standard CD-ROM and CD-XA formats.

Once you get used to the interface, there's little that you can't do using CD-It!All, but this package is targeted squarely at the multimedia authoring market, with a heavy emphasis on CD-I. Casual users will be better served by a general-purpose package like Corel CD Creator, Incat's Easy-CD Pro, or Optical Media's QuickTopix—but for Video-CD support, CD-It!All is your best choice.

CD-It!All 1.13. List price: $999. OptImage Interactive, West Des Moines, IA; 800-234-5484, 515-225-7000; fax, 515-225-0252; info@optimage.com. *Circle 498 on reader service card.*

Creative Digital Research Inc.

CDR Publisher HyCD

Products that claim to provide a solution for both novice and advanced users usually fail with at least one segment of the intended audience. Creative Digital Research's $495 CDR Publisher HyCD 4.1—available in Windows 3.1 and Windows NT versions—succeeds with both segments. It is easily the most versatile premastering package we encountered among both bundled and third-party software. It boasts a refined user interface that is friendly to both novices and advanced users.

CDR Publisher is the only software that can integrate ISO 9660 (PC), HFS (Mac), and Rock Ridge (Unix) file formats on a single CD-ROM. It also goes beyond mere cross-platform compatibility to include advanced features such as network support, file placement optimization, system-profiling tools, and testing via a simulated CD-ROM. You can even create a Bootable CD for DOS and Unix systems that support this feature (Plug and Play Option ROMs can be set to do this under Windows 95). CDR Publisher also offers a free Developers Kit, which you can download from the company's Web site, that lets you embed CDR Publisher's mastering engine in your own customized applications.

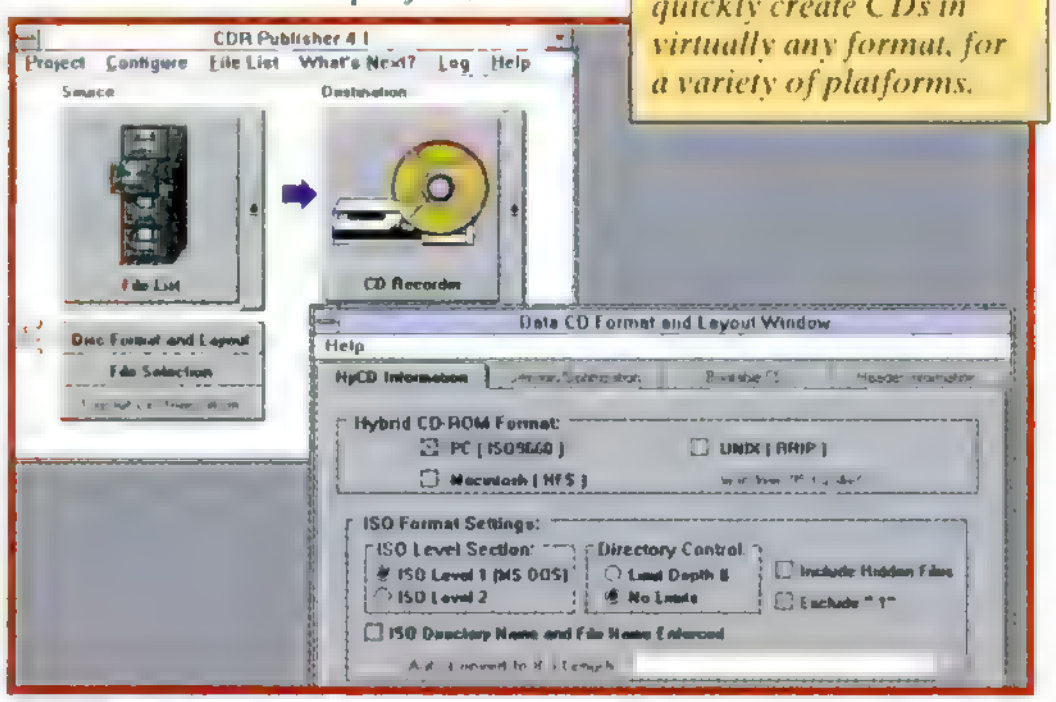
CHOICES, CHOICES

With numerous format options and input sources, CDR Publisher offers great versatility to the CD developer. The package supports every conceivable CD format—including CD-ROM, CD-ROM XA, CD-I, CD-DA, and CD Plus—and it also contains all the tools necessary to create a Video-CD 2.0 disk. Note that this is not a casual procedure; it's probably beyond all but the most experienced developers.

CDR Publisher can read directly from a wide variety of SCSI-based source devices including prerecorded CDs, DAT, virtual- and physical-image files, and individual track files. Writing options are equally robust. CD recorders, track files, image files, virtual disks, and DAT are all valid destinations, but all must be SCSI-based.

CD Publisher's graphical interface is intuitive and consistent across all the platforms the package supports (PC, Mac, and several Unix flavors). Novices will appreciate the What Next? wizard, which gently nudges you through the CD-recording process; more advanced users can turn off the wizard and focus on customizing the process via child windows that feature a clean folder/tab interface.

To begin the process of creating your CD, you simply scroll through pictorial representations of the various devices to define your source and destination, select the disk format and layout, drag and drop to create a file or track list, and click on Create Image. The program creates a running log file to help you isolate problems or investigate errors. When you're done, you can save the entire project, including any associated optimization instructions and custom configurations so you have templates for future work.



CDR PUBLISHER'S *intuitive interface lets new and advanced users alike quickly create CDs in virtually any format, for a variety of platforms.*

The program ran smoothly through a gauntlet of standard CD-R tasks: backing up over 15,000 files on the fly, creating Photo CD multisession disks, reading externally generated ISO 9660–image files, and generating CD Plus disks. CDR Publisher can burn a CD directly from a prerecorded CD-ROM in a standard CD reader, but we were unable to generate a CD directly from a CD-DA (audio) disk. Instead we got an error message that claimed our Plextor 6Plex CD reader did not support this feature.

CDR Publisher largely succeeds at appealing to both the novice and the experienced user. The package's ability to create HyCD disks, with PC, Mac, and Unix native-format volumes coexisting on a single disk, is especially useful in corporate environments where multiple-platform networks are common. Even if all you need to do is back up your hard disk to a CD, with CDR Publisher you're just three steps away.

CDR Publisher HyCD 4.1. List price: $495. Creative Digital Research Inc., San Jose, CA; 408-255-0999; fax, 408-255-1011; http://www.cdr1.com. *Circle 499 on reader service card.*

Optical Media International

QuickTopix

Don't let Optical Media International's QuickTopix V2.20 for Windows fool you with its simple appearance. As a general-purpose CD development package, it may offer significant improvements over the software that came bundled with your CD-R drive. QuickTopix comes in a Windows 3.1 version ($195) and a Windows 95/Windows NT version ($395).

QuickTopix can also create both ISO 9660– and Apple HFS–formatted disks or hybrid disks containing native partitions of both types that can run on PCs and Macs. This cross-platform capability is an unusual strength that may be vital for certain development projects.

QuickTopix uses a standard Windows Setup routine that worked easily and efficiently in Windows 3.11, Windows 95, and Windows NT. The interface is consistent under all three operating systems, but the Windows 95/Windows NT version is a true 32-bit application that supports multithreaded I/O. Theoretically you now have the ability to write simultaneously to several CD recorders simply by running multiple instances of the program. In practice, though, you will probably need separate hard disks and controllers for a second simultaneous recording session in order to prevent buffer underruns.

If you have access to a Mac-formatted hard disk or SyQuest drive, it's fairly simple to create HFS disks; just mount the HFS drive and create or modify the preexisting sample template. To create a hybrid disk containing both ISO 9660 and HFS file formats, you need to create each volume separately using separate templates. Similarly, to create an Enhanced CD (CD Plus) disk, QuickTopix requires a multistep approach. While the package supports both CD-ROM XA Mode 2, Form 1, and CD-DA (Red Book audio), you need to write

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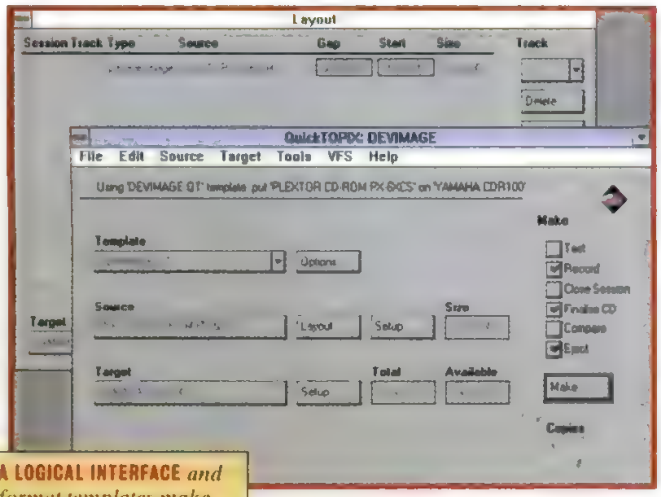
CD CREATE YOUR OWN

the audio tracks first, close the session, and then append a CD-ROM XA Mode 2, Form 1 data track.

READY TO BURN

There are many variables to set when preparing to burn your own CD, and QuickTopix makes the process logical. The main screen is neatly divided into four sections: Template, Source, Target, and Make. The Template section functions as a general controller, defining the overall track layout and settings such as file formats and recording speed. QuickTopix provides six premade sample templates, but most users will use these as a starting point for creating their own.

For example, if you select the ISO9660.QT template, you've automatically set the Source to ISO 9660 Track, the Target to your default CD recorder, and the recording speed to the current default value for recording a data track. QuickTopix gives you more than a single default to maximize flexibility and functionality.



A LOGICAL INTERFACE *and format templates make creating a CD easy with QuickTopix.*

In the Target section, you define whether you are sending your work to the CD-R drive or to an output file. The Make section features a test run where you can troubleshoot your CD setup without wasting a disk. Note that only the Windows 3.1 version of QuickTopix gives you the ability to test your proposed CD layout by letting you create a simulated CD drive from a virtual image file.

QuickTopix can use an IDE-based hard disk as a source device, but in our testing it could not read from the Windows 95 test system's Panasonic IDE CD-ROM drive. The SCSI-based Plextor 6Plex CD-ROM reader in our Windows 3.11 test-bed worked quite well with the program, however, and we were able to copy a CD-ROM image directly to a CD-R without creating an intermediary physical ISO image file.

Whether you're looking for a general-purpose CD-R software package that's easy to use or the ability to create cross-platform applications, QuickTopix has what it takes to suit your needs.

QuickTopix V2.20 for Windows. List price: Windows 3.1 version, $195; Windows 95/Windows NT version, $395. Optical Media International, Campbell, CA; 800-347-2664, 408-376-3511; fax, 408-376-3519; http://www.microtest.com. *Circle 500 on reader service card.*

Philips Media OptImage

Video CD 2.0 Toolkit

Video CD 2.0 Toolkit 1.0 ($1,500), from Philips Media OptImage, is a Video-CD multimedia authoring tool, not a pre-mastering package, but it is a key ingredient if you need to create a Video-CD on your PC. The product contains everything you need to merge disparate data into a coherent multimedia presentation, and it can build the complex image files that your premastering software needs to burn a valid Video-CD.

VIDEO-CD: WHAT IS IT?

Video-CD 2.0 is a format designed to create CDs that play in both dedicated Video-CD players and CD-I players equipped with a Digital Video cartridge. To play a Video-CD on your PC, you need a CD-ROM reader capable of reading CD-ROM XA disks, an MPEG-1 decoder (hardware or software), and a playback application.

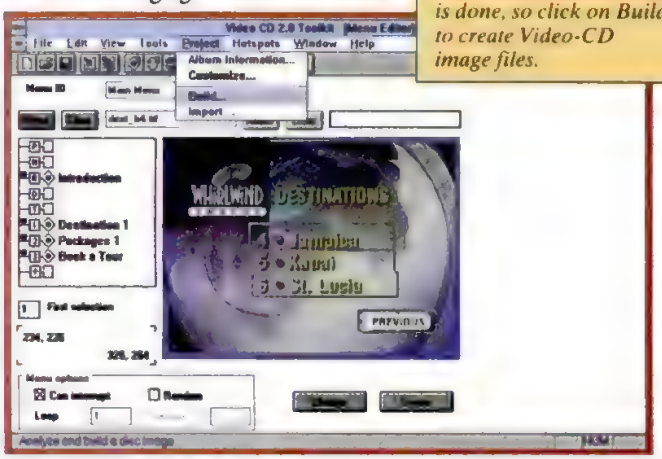
Video-CD provides a means of distributing interactive video to devices with wide-ranging capabilities. Video-CD shows up anywhere from interactive video games to the kiosks that let you preview albums before you buy them at your local CD outlet. Video CD 2.0 Toolkit lets you create an interactive video presentation complete with hot spots and multiple audio/video sequences that is not limited to the PC market.

Each Video CD 2.0 Toolkit project begins with a skeletal *sequence*, which is a time line you create for the information flow through the interactive application. To flesh out the sequence, you define basic objects like menus and events, drag and drop them into the main sequence, and tie *assets* (audio, video, and still pictures) to each event. You can walk through your presentation to test the on-screen hot spots and keyboard events you've defined and connect sequences across multiple volumes (or disks).

When you're satisfied with your work, use the Build pull-down menu to reconcile the files, convert to Video CD 2.0–compatible formats, and output the .TOC (CD-I table of contents) and .CD (image) files that OptImage's CD-It!All product uses to burn the actual disk. Video-CD disks use a multitrack CD-I Bridge structure. The first track is a special data track that contains the CD-I player application, .TOC information, and any MPEG still pictures, MPEG motion sequences, or MPEG audio. Subsequent tracks are reserved for interleaved MPEG audio/video, followed by CD-DA (Red Book audio). Video CD 2.0 Toolkit's Build procedure handles the details of this complex structure and boils it down to a single click from a pull-down menu. Structural errors and other relevant messages are logged, so little is actually hidden from the end user. The result is a full-blown Video-CD image that you can send directly to an appropriate service bureau or feed into a premastering package such as CD-It!All.

If your target audience is PC-bound, you can create a multimedia presentation with any of the authoring packages reviewed in this issue's feature on multimedia authoring tools and burn your own CD-ROM XA disk with any premastering software that can interleave XA streams. But Video CD 2.0 Toolkit takes the next giant step, opening up the lucrative consumer electronics market while maintaining PC compatibility. □

Video CD 2.0 Toolkit 1.0. List price: $1,500. Philips Media OptImage, West Des Moines, IA; 800-234-5484; fax, 515-225-0252; info@optimage.com. *Circle 501 on reader service card.*



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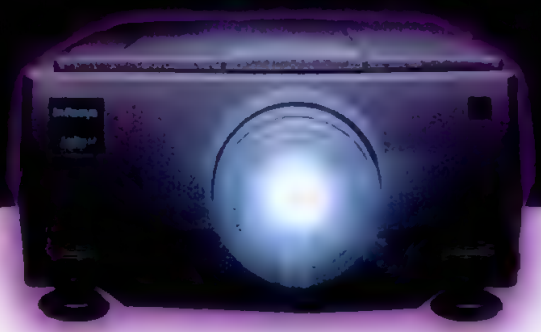

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By Jeff Prosise

Digital Signatures: How They Work

Checksums, cyclic redundancy checks, hash algorithms, and digital signatures are the keys to authenticating digitally transmitted data.

Imagine yourself in the following situation: A colleague just e-mailed you a memo containing confidential budget figures for the upcoming year. You have to be absolutely certain that the copy you received is genuine and that the numbers in it weren't altered during the transmission. A couple of transposed characters could cost your company millions of dollars. You're suspicious that the document may have been tampered with en route, because some of the numbers don't add up and the e-mail was routed through an external mail system. How do you know beyond a shadow of a doubt that the document you're looking at is identical to the document that was originally transmitted?

This scenario isn't as farfetched as it may seem. In a day and age when digital commerce is fast becoming a reality, one's confidence in digital transactions is wholly dependent upon the security surrounding such transactions. If you send a spreadsheet file to someone via e-mail or on a floppy disk, how does the recipient know that the spreadsheet wasn't altered by someone who had intermediate access to it? If you send a credit card number over the Internet, how does the recipient know that it really was you who placed the order?

The answers to these questions lie in a field of mathematics known as cryptography. The term *cryptography* implies encryption, but cryptography isn't limited to theories of data encryption. It also addresses issues related to digital authenticity—how you know that electronic data is real and how electronic documents can be "signed" with 1s and 0s that are analogous to handwritten signatures on paper. This article explores key principles of digital authenticity, beginning with simple methods for verifying the integrity of electronic data and concluding with a discussion of the U.S. government's proposed Digital Signature Standard and of digital signatures in general.

CHECKSUMS

The simplest method of verifying the integrity of digitally transmitted data is the *checksum* method. A checksum is a value computed by adding together all the numbers in the input data. If the sum of all the numbers exceeds the highest value that a checksum can hold, the checksum equals the modulus of the total—that is, the remainder that's left over when the total is divided by the checksum's maximum possible value plus 1. In mathematical terms, a checksum is computed with the equation

```
Checksum = Total % (MaxVal + 1)
```

where `Total` equals the sum of the input data and `MaxVal` is the maximum checksum value you will allow.

Suppose the document whose contents you wish to verify is the following stream of 10 byte values:

```
36 211 163 4 109 192 58 247 47 92
```

If the checksum is also a 1-byte value, then it can't hold a number greater than 255. The sum of the values in the document is 1,159, so the 8-bit checksum is the remainder left when 1,159 is divided by 256, or 135. If the person who sent the document calculated a checksum of, say, 246, and you get a checksum of 135, then the data was altered. A checksum is the simplest form of *digital fingerprint*—a value, calculated from the content of other data, that changes if the data upon which it's based changes. Checksums have been used since the dawn of computing and are still the basis for error checking in some forms of the popular XMODEM file-transfer protocol.

The problem with checksums is that although conflicting checksums are proof positive that a document has been altered, matching checksums doesn't necessarily prove that

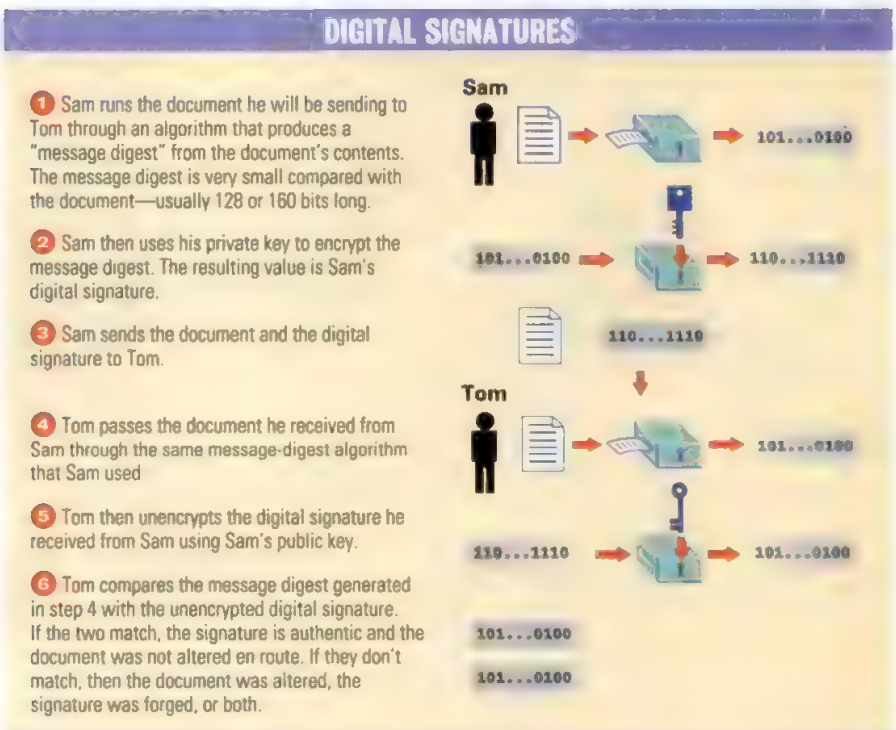

FIGURE 1: *Using hash algorithms in conjunction with public-key cryptosystems creates a digital signature to verify the authenticity of a set of input data.*

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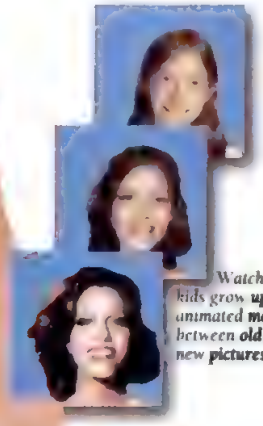

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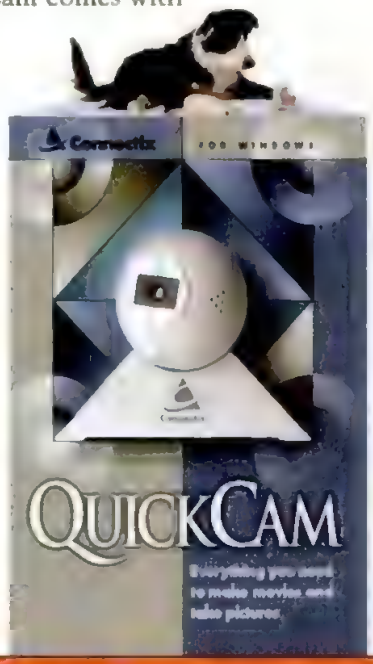

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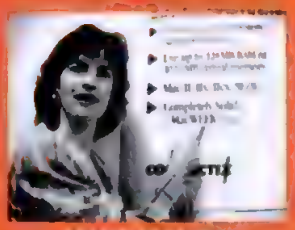

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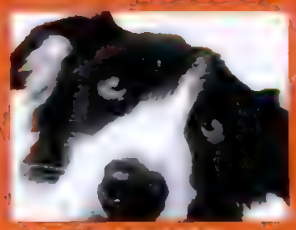

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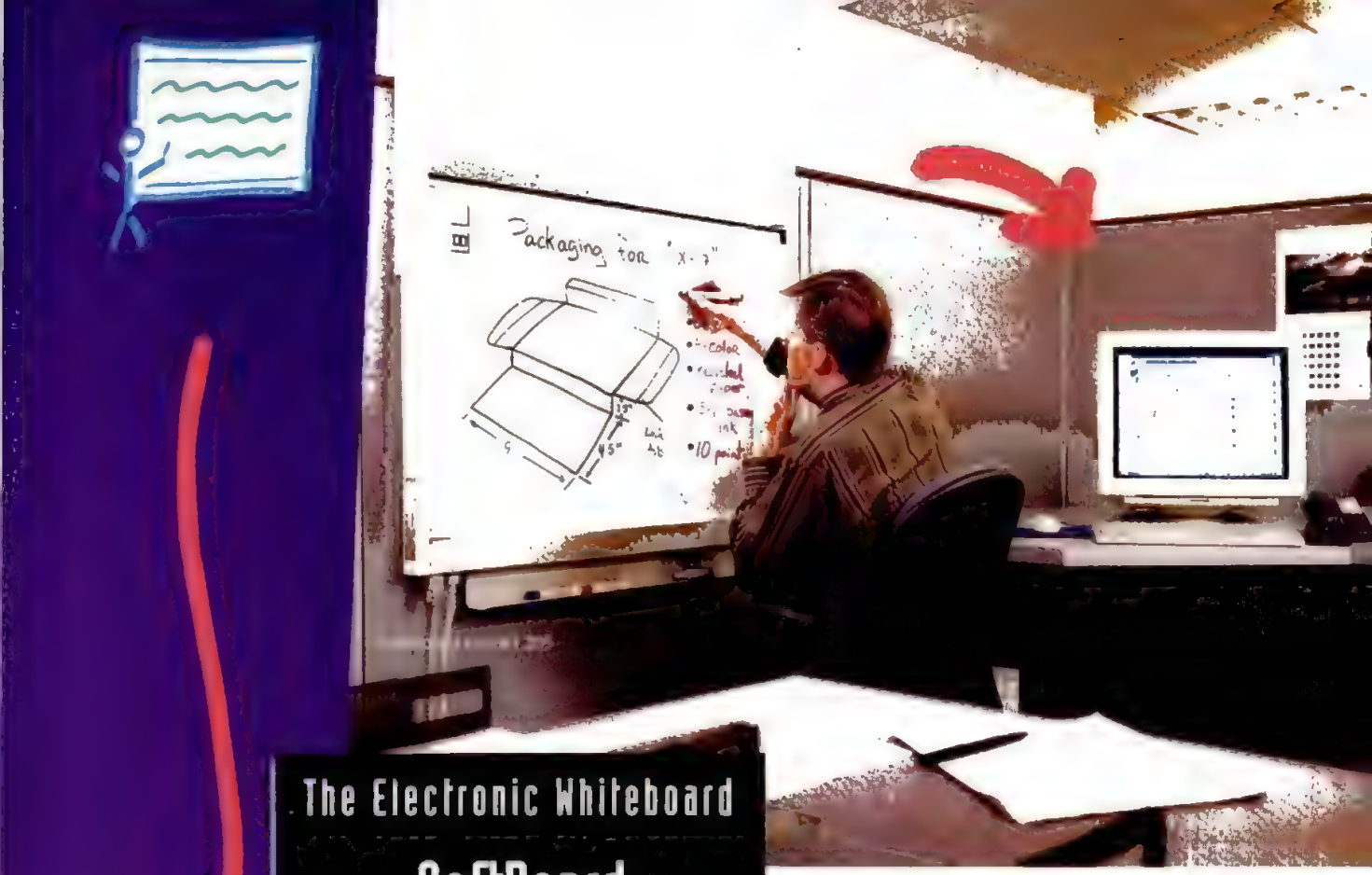

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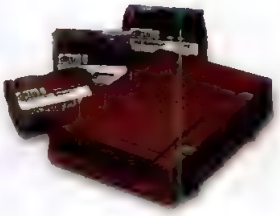

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the data was *not* altered. You can reorder the numbers in the document any way you want and the checksum won't change. Worse, you can change individual numbers in the document and tweak others so that the checksum comes out the same. When you use 8-bit checksums, there's a 1 in 256 chance that two completely *random* data streams will have the same checksums. Expanding the checksum length to 16 or 32 bits decreases the odds of coincidental matches, but checksums are still too susceptible to error to provide a high degree of confidence in the data they represent.

CYCLIC REDUNDANCY CHECKS

A better way to digitally fingerprint a block of data is to compute a cyclic redundancy check (CRC) value for it. CRCs have been used for years in network adapters, disk controllers, and other devices to verify that what goes in equals what comes out. Also, many modern communications programs use them to perform error checking on packets of data transmitted over phone lines.

The mathematics behind CRCs is based on something called *polynomial division*, in which each bit in a chunk of data represents one coefficient in a large polynomial. A polynomial is a mathematical expression like this one:

$$f(x) = 4x^3 + x^2 + 7$$

For the purpose of CRC calculations, the polynomial that corresponds to the byte value 85 (whose 8-bit binary equivalent is 01010101) is

$$0x^7 + 1x^6 + 0x^5 + 1x^4 + 0x^3 + 1x^2 + 0x^1 + 1x^0$$

or simply

$$x^6 + x^4 + x^2 + 1$$

The key to CRC calculations is that polynomials can be multiplied and divided just like ordinary numbers. Dividing a "magic" polynomial (one whose coefficients are dictated by the CRC algorithm you're using) into the polynomial generated from a data stream yields a quotient polynomial and a remainder polynomial. The latter forms the basis of a CRC value. Like checksums, CRCs are small (usually 16 or 32 bits in length), but they're far more reliable at detecting minor changes in the input data. If just one bit in a large block of data changes, there's a 100 percent chance that the CRC will change, too. If two bits change, there's better than a 99.99 percent chance that a 16-bit CRC will catch the error. Swapping two bytes or adding 1 to one and subtracting 1 from another won't fool a CRC as it will a checksum.

CRCs are extremely useful for checking files downloaded from online services. When someone contacts me on ZD Net about a utility that's crashing inexplicably, the first thing I usually ask them to do is zip the file with PKZIP and type PKZIP-V to view the .ZIP file. One of the things they see is the 32-bit CRC value PKZIP computed for the uncompressed file. If the CRC computed from the downloaded utility is not the same as the CRC for the file I uploaded, we know that there was an undetected transmission error during the download. (It happens.)

You can use CRCs to fingerprint files yourself by downloading CRC.COM from PC Magazine Online. (It's in the Tutor library of ZD Net/CompuServe's Utilities/Tips forum and in the file V15N07.ZIP on our Internet server at *http://www.pcmag.com.*) CRC.COM is a DOS utility that takes a filename as input and computes a 32-bit CRC value from the file's contents. It uses the popular CRC-32 algorithm used by PKZIP and IBM Token-Ring network adapters. It's also very fast (written entirely in assembly language, it uses buffered disk I/O and a "smart" implementation of the CRC-32 algorithm to minimize the number of computations) and will handle files of any size. If you transmit a file to a friend via modem, CRC.COM is a great tool for making sure the data made it through intact.

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```
CRC CRC.COM
```

at the DOS prompt. If the resultant CRC value is not 86C237FA, then you should download the file again.

HASH ALGORITHMS AND MESSAGE DIGESTS

The problem with even a 32-bit CRC value is that although it's pretty good at detecting inadvertent changes to the input data (such as those introduced by transmission errors), it doesn't stand up very well to intentional attacks. If you use a 32-bit CRC to fingerprint a file, it's relatively easy for someone with access to a computer to generate a completely different file that produces the same CRC value.

A step beyond CRCs are one-way hash algorithms that produce "hash" values. "One way" means it's easy to input A and get B, but it's impossible—or nearly impossible—to work backward from B to A. A good hash algorithm has one very important property: The values that it generates are so unique and so difficult to duplicate that not even someone with a bank of Cray supercomputers and a few centuries to kill could find two sets of input data that produce the same hash value. Typically, hash values are at least 128 bits in length. The greater the length, the more difficult it is to reproduce the input or to find another set of input data that produces a matching result.

Two of the most widely known one-way hash algorithms are the MD5 message digest algorithm developed by MIT professor Ron Rivest (one of the developers of the highly regarded RSA public-key cryptosystem) and the Secure Hash Algorithm (SHA) developed by the National Institute of Standards and Technology (NIST) and the National Security Agency (NSA). MD5 produces a 128-bit digital fingerprint from a set of input data, and SHA produces a 160-bit value. Assuming no one discovers a heretofore unknown "trap door" to either algorithm, it is computationally unfeasible to take a hash value produced by SHA or a "message digest" produced by MD5 and work backward to find the input data. Thus, if someone sends you a file and an MD5 or SHA fingerprint generated from the file, and if you run the same hash algorithm on the file you receive and get the same result, you can be virtually certain the file was received intact.

DIGITAL SIGNATURES AND PUBLIC-KEY CRYPTOSYSTEMS

Hash algorithms can be combined with public-key cryptosystems to produce *digital signatures* that guarantee the authenticity of a set of input data the same way a written signature verifies the authenticity of a printed document. A public-key cryptosystem is a method of encrypting and decrypting information that relies on two input keys: a public key that is freely disseminated to everyone and a private key that is known only to its holder.

Think of a key as a password. If Tom wants Sam to be able to send him an encrypted document, and neither Tom nor Sam wants to risk transmitting a password or key because it might be intercepted, Tom can give Sam his public key (see Figure 1). Sam encrypts the document with Tom's public key and sends it to Tom. Tom then decrypts the document with his private key, which is the *only* key that will decrypt a document encrypted with Tom's public key. It doesn't matter if someone has Tom's public key, because it's of no value in decrypting the document. And the private key, which is known only to Tom, doesn't have to be transmitted; theoretically, it never has to leave Tom's head. Conversely, some public-key cryptosystems allow Sam to encrypt the document with his own private key and then give his public key to Tom so Tom can unencrypt the document. Public-key cryptosystems such as RSA (the acronym was derived from the first letters of the surnames of the algorithm's three authors) already exist and are in wide use today.

How do digital signatures work? Here's one example. Suppose Sam wants to send Tom a contract or credit card number electronically and Tom needs an electronic signature to verify authenticity. First Sam sends the document. Then he uses a hash algorithm to generate a fingerprint for the document,

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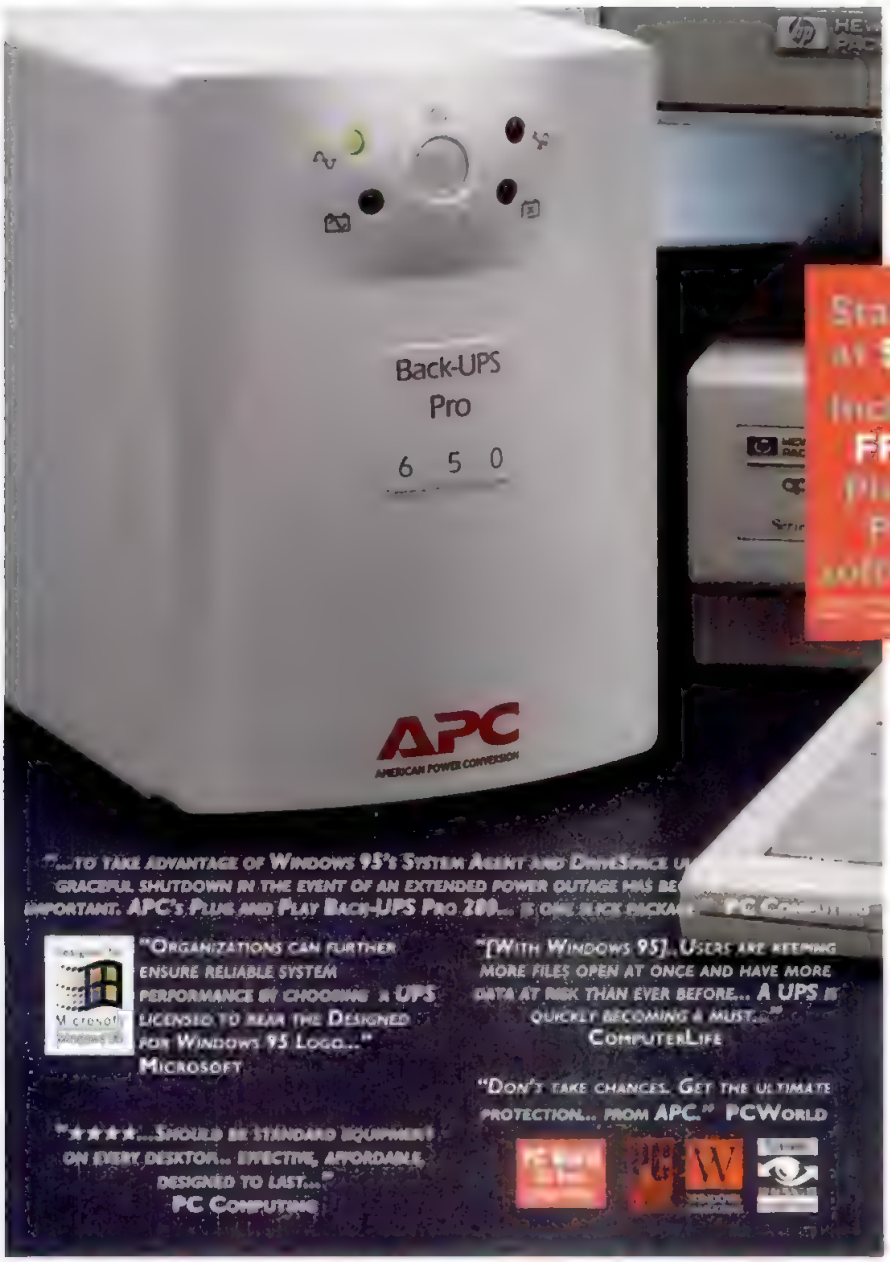

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encrypts the hash value with his private key, and sends the encrypted hash value to Tom. This is Sam's digital signature. Tom uses the same hash algorithm to fingerprint the document he received and then unencrypts the hash value he received from Sam using Sam's public key. If the two hash values match, then Tom not only knows that the document he received is authentic, but he also knows that Sam's signature is real. Conducting commercial transactions this way is arguably more secure than using paper signatures, because paper signatures can be forged. And if the information that Sam sent to Tom is sensitive (for example, if it contains a credit card number), then it, too, can be encrypted so that only Tom can read it.

This model—or one similar to it—is probably the one we'll use to conduct business on the Internet and elsewhere. It is the basis for the U.S. government's proposed Digital Signature Standard (DSS), which relies on the Secure Hash Algorithm to produce hash values and a public-key cryptosystem known as the Digital Signature Algorithm (DSA) to produce signatures from hash values. The DSS has been criticized for various reasons, but much of the criticism comes from parties who have a financial interest in seeing that it's not adopted.

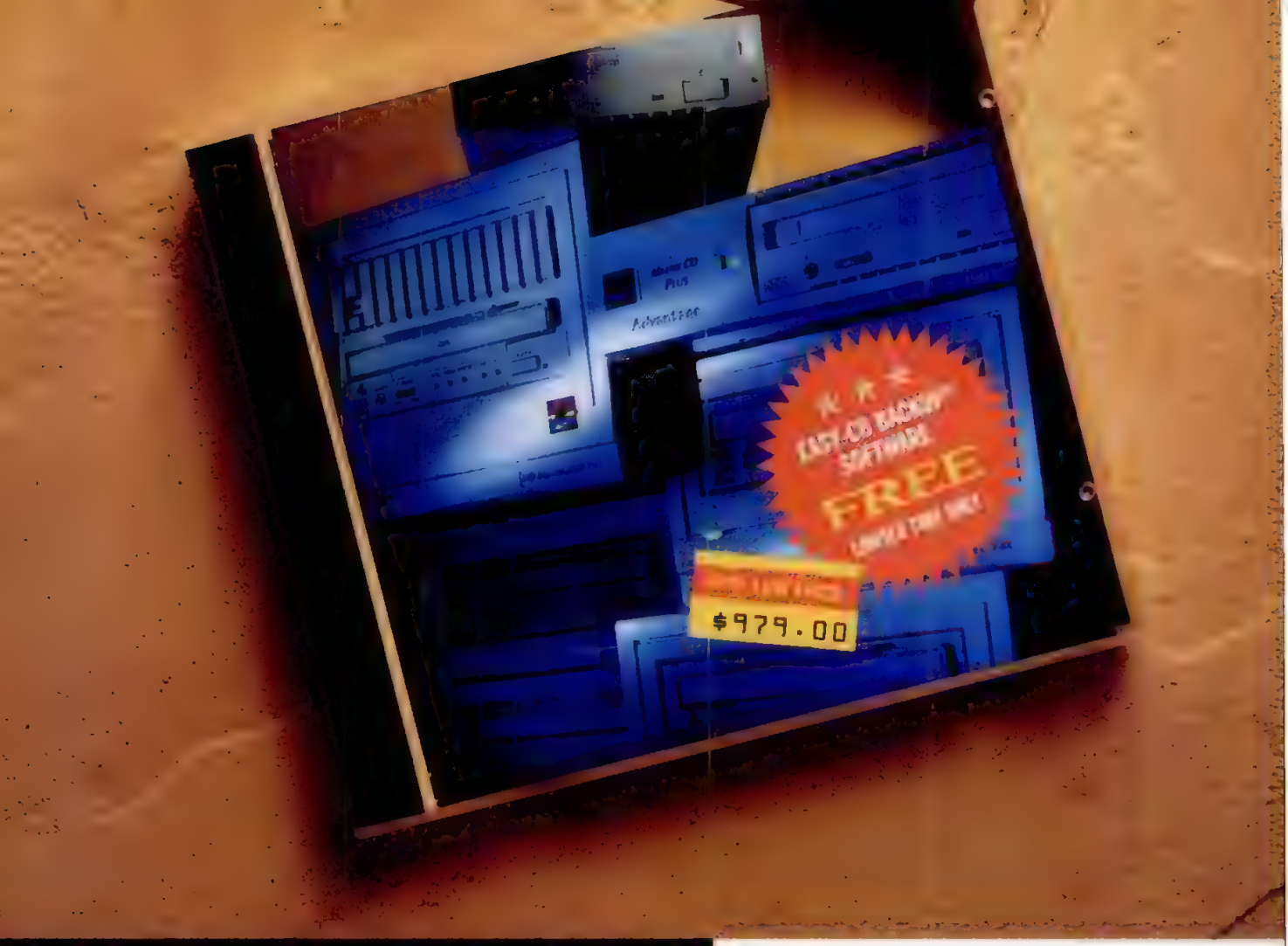
Time will tell which, if any, method for creating digital signatures will become the standard. Regardless of the outcome, of greater importance is that it *is* possible to conduct electronic commerce in a secure fashion.

FURTHER READING

If you'd like to learn more about hash functions, public-key cryptosystems, and digital authenticity in general, I highly recommend Bruce Schneier's excellent book *Applied Cryptography: Protocols, Algorithms, and Source Code in C* (1995, John Wiley & Sons). The recently published second edition is the most authoritative work of its kind anywhere, and it's loaded with useful information that includes detailed descriptions of the algorithms, the mathematics behind them, and the efforts to crack them.

For more information on CRCs and how to write code that generates them, check out W. David Schwaderer's *C Programmer's Guide to NetBIOS* (1988, Howard W. Sams & Company) and Joe Campbell's *C Programmer's Guide to Serial Communications* (1987, Howard W. Sams & Company). I've used these two books for years and find them to be invaluable resources for understanding the principles of digital data transmission and authentication. □

Jeff Prosise is a contributing editor of PC Magazine. *His new book,* Programming Windows 95 with MFC *(Microsoft Press), is due out this spring.*



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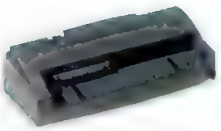

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CIRCLE 188 ON READER SERVICE CARD

By John Lam

OLE Automation Collections

Creating an Automation Collection Object with Delphi 2.0.

Programmers need places to store data and other objects, and OLE Automation *Collections* were invented for just this reason. Collections, which can often take the place of arrays or linked lists, let you store and retrieve data according to a standard interface. What this standard is, and how we can put it to use, will be our focus.

In a previous installment of this column ("Reusable Binary Components," March 12, 1996), I described in detail how you would go about creating a linked list in C++ for use in Visual Basic. Recall that a linked list is a way of organizing data for rapid addition and deletion of individual elements. This time I'll show you how to port our linked-list object to the new 32-bit edition of Delphi and add the ability to access its data via the Automation Collection standard.

Visual Basic 4.0, which uses the VBA (Visual Basic for Applications) engine, adds some additional syntax for dealing with Collections. A simple little loop that iterates over each Element in the collection called MyCollection would look like this:

```
For Each Element in MyCollection
debug.print Element
next
```

Collections can contain simple data types, or they can contain other Automation Objects. Each element in MyCollection is returned in the Variant variable named Element. By manipulating Element, we can access the data that it contains. In this case we simply print its contents to the Debug window. But how does VBA actually talk to the Collection and get it to show us its data? For that information you must read on, but I'll tell you now that the work is done by a little-known OLE interface called IEnumVariant.

To understand IEnumVariant and its friend IDispatch, we're going to have to take a closer look at OLE and COM. COM is the Component Object Model, a set of standards that define how binary objects can talk to each other. Just like in traditional programming languages where you carefully set up your modules to talk to each other through module interface functions, COM objects talk to each other through COM interfaces. A standard naming convention has evolved that calls for every COM interface name to begin with a capital I. You will learn how COM interfaces are defined, how they work, and how to create your own COM interfaces. In the course of adding Automation Collection support to our linked-list object, you will learn how the two key interfaces IDispatch and IEnumVariant work together to create the Automation Collection.

```
IDispatch = class(IUnknown)
  public
    function GetTypeInfoCount(var ctinfo: Integer): HResult;
      virtual; stdcall; abstract;
    function GetTypeInfo(itinfo: Integer; lcid: TLCID;
      var tinfo: ITypeInfo): HResult; virtual; stdcall; abstract;
    function GetIDsOfNames(const iid: TIID; rgszNames: POleStrList;
      cNames: Integer; lcid: TLCID; rgdispid: PDispIDList):
      HResult; virtual; stdcall; abstract;
    function Invoke(dispIDMember: TDispID; const iid: TIID;
      lcid: TLCID; flags: Word; var dispParams: TDispParams;
      varResult: PVariant; excepInfo: PExcepInfo; argErr: PInteger): HResult;
      virtual; stdcall; abstract;
  end;
```

FIGURE 1: *The Object Pascal declaration for IDispatch.*

A QUICK LOOK AT COM

The interfaces that COM objects use to communicate with each other are stored as a table of pointers to functions. This table is identical in structure to the v-tables used for dispatching virtual functions in both C++ and Delphi. Therefore, creating COM objects in these languages is as easy as creating any other object. The language that we will be using in this article is Delphi 2.0.

The ancestor of all COM interfaces is IUnknown. It implements three simple functions: AddRef, Release, and QueryInterface. The first two functions provide an important service required by all COM objects: reference counting. Since a COM object can potentially service many other objects, it needs to keep track of how many other objects are currently referencing it. AddRef increases the reference count and Release decreases it. When the reference count decreases to zero, Release automatically frees the COM object.

The third function, QueryInterface, provides access to other interfaces that are implemented by a COM object. Through QueryInterface, an object that has a pointer to another object's IUnknown interface can discover at runtime what other interfaces that object supports and obtain a pointer to any of those interfaces.

All other COM interfaces must be derived from IUnknown, and they all must implement the three IUnknown interface functions AddRef, Release, and QueryInterface. We can create a new COM interface by deriving a new class from IUnknown:

```
type

IMyInterface = class(IUnknown);
function Foo: Integer; virtual;
➥stdcall;
procedure Bar(S: String); virtual;
➥stdcall;

end;
```

In this example, the new COM interface IMyInterface contains the virtual member functions Foo and Bar, in addition to AddRef, Release, and QueryInterface from IUnknown. For a more detailed discussion of how COM interfaces work, take a look at the references provided at the end of this article.

```
TVariantArg = record
    vt: TVarType;
    wReserved1: Word;
    wReserved2: Word;
    wReserved3: Word;
    case Integer of
      VT_UI1:                  (bVal: Byte);
      VT_I2:                   (iVal: Smallint);
      VT_I4:                   (lVal: Longint);
      VT_R4:                   (fltVal: Single);
      VT_R8:                   (dblVal: Double);
      VT_BOOL:                 (vbool: TOleBool);
      VT_ERROR:                (scode: HResult);
      VT_CY:                   (cyVal: TCurrency);
      VT_DATE:                 (date: TOleDate);
      VT_BSTR:                 (bstrVal: TBStr);
      VT_UNKNOWN:              (unkVal: IUnknown);
      VT_DISPATCH:             (dispVal: IDispatch);
      VT_ARRAY:                (parray: PSafeArray);
      VT_BYREF or VT_UI1:      (pbVal: ^Byte);
      VT_BYREF or VT_I2:       (piVal: ^Smallint);
      VT_BYREF or VT_I4:       (plVal: ^Longint);
      VT_BYREF or VT_R4:       (pfltVal: ^Single);
      VT_BYREF or VT_R8:       (pdblVal: ^Double);
      VT_BYREF or VT_BOOL:     (pbool: ^TOleBool);
      VT_BYREF or VT_ERROR:    (pscode: ^HResult);
      VT_BYREF or VT_CY:       (pcyVal: ^TCurrency);
      VT_BYREF or VT_DATE:     (pdate: ^TOleDate);
      VT_BYREF or VT_BSTR:     (pbstrVal: PBStr);
      VT_BYREF or VT_UNKNOWN:  (punkVal: ^IUnknown);
      VT_BYREF or VT_DISPATCH: (pdispVal: ^IDispatch);
      VT_BYREF or VT_ARRAY:    (pparray: ^PSafeArray);
      VT_BYREF or VT_VARIANT:  (pvarVal: PVariant);
      VT_BYREF:                (byRef: Pointer);
end;
```

FIGURE 2: *The definition of the Variant data type.*

THE HEART OF AUTOMATION: IDISPATCH

Since the focus of this article is Automation Objects, let's look at the interface that is the heart of OLE Automation: IDispatch. IDispatch is a standard COM interface and inherits from IUnknown. Its Object Pascal declaration is shown in Figure 1.

The first two member functions, GetTypeInfoCount and GetTypeInfo, are for manipulating type libraries. Type libraries are repositories of metadata that describe an Automation Object's methods and properties. By binding to a type library, an OLE Automation controller can discover at runtime the number and types of parameters that a given method requires. This can make calling methods of an Automation Object much more efficient, as I will discuss later.

The other two functions, GetIDsOfNames and Invoke, are the workhorse functions of Automation. To clarify what their roles are, let's take a look at a simple example of VBA code that creates a new instance of an Automation Object called TestObject and calls its GetObjectTitle method:

```
Const MAINCAPTION = 1
Dim myObject as Object, sMainCaption$
Set myObject =
➥CreateObject("TestObject")
sMainCaption =
➥myObject.GetObjectTitle( MAINCAPTION )
```

We create a new instance of TestObject in the third line. The TestObject argument for CreateObject is known as a ProgID (short for Program ID). This is simply a human-readable string that uniquely identifies an Automation Object on the computer. VBA uses the ProgID to look up TestObject's GUID (globally unique identifier) in the system registry. VBA then calls an OLE library function, CoCreateInstance, to construct a new instance of TestObject and to obtain a pointer to TestObject's IUnknown interface. By calling the QueryInterface function of TestObject's IUnknown interface, VBA can obtain TestObject's IDispatch interface. Since TestObject is an Automation Object, it returns a pointer to its IDispatch interface, and VBA sets myObject to this value.

The fun really begins when we call the GetObjectTitle method of TestObject. This is a simple function call, but VBA is doing quite a bit beneath the surface. Let's first consider the simplest case of calling an Automation object. VBA calls GetIDsOfNames with GetObjectTitle as a parameter. If GetObjectTitle is a valid member function of TestObject (keep in mind that TestObject implements the GetIDsOfNames function, so it should know!), then GetIDsOfNames returns a Dispatch ID (DispID) for GetObjectTitle.

Using the DispID, VBA calls GetObjectTitle via the Invoke function. The parameters for a method are passed as an array of Variants pointed to by the dispParams parameter of Invoke. In this case, we are passing a single Integer parameter, MAINCAPTION, so the Variant array contains only one value. The return value of GetObjectTitle is passed back as a string Variant in the varResult parameter of Invoke, and VBA assigns this string to sMainCaption. This is the simplest way that VBA can talk to an Automation Object. If the Automation Object also contains a type library, however, then things get more interesting.

BINDING VIA A TYPE LIBRARY

There are OLE Automation controllers of varying levels of sophistication on the market. Visual Basic 4.0 is currently the most feature-packed controller available. Why? VB4 uses the GetTypeInfo function of IDispatch that we mentioned earlier. This allows VB4 to obtain, in one fell swoop, the names and parameter types of all methods and properties that are supported by the Automation Object. Therefore, VB4 does not need to call GetIDsOfNames in order to get the DispIDs required by the Invoke function. This results in a significant performance advantage over other OLE Automation controllers.

But even greater performance is possible. An Automation Controller that uses type libraries can support what is known as "dual" interfaces, which offer the performance advantage of a v-table interface with the late-binding flexibility of an IDispatch interface. The first seven member functions of a dual interface are the same as those of the IDispatch interface. A dual interface, however, has more member functions. The Automation methods that are called by Invoke also have entries in the v-table beginning at entry 8. An Automation Controller that reads the Automation Object's type library can discover what parameters are required by those v-table functions. Therefore, the Controller can call those functions directly via their v-table entry and bypass the Invoke function altogether. This also has the benefit of not requiring the parameters to be passed as Variants, which further improves performance. Currently, VB4 is the only Automation Controller that supports dual interfaces.

FIGURE 3: *The layout of a Basic string (BSTR).*

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AUTOMATION PARAMETERS

It is also important to understand how Automation parameters are structured. As I mentioned earlier, Variants are the primary data type of Automation. A Variant is a 16-byte packet of data defined as shown in Figure 2.

Most Variant data types are passed by value—the data is contained entirely within the Variant itself—but a notable exception is strings. Automation strings are known as Basic strings, or BSTRs. A BSTR is a hybrid between a Pascal string and a C-style null-terminated string (see Figure 3).

BSTRs offer fast concatenation and lookup speed like Pascal strings, because the length of the string is contained within the string itself. They're also flexible, since the "built-in" C string can be passed to API functions that expect to receive null-terminated strings.

Variable-length strings provide a lot of flexibility for programmers. However, flexibility sometimes creates its own set of problems. A string Variant contains a pointer to the memory allocated for the BSTR. Since the memory allocated by the string Variant is used for parameters that will be passed between objects, an ownership issue arises: Who owns the memory for the string? Is it the calling object or the receiving object? By convention, it is the receiving object that bears the responsibility for freeing the memory used by the string after it is done with it. But how does one object free memory that was allocated by another object's memory allocator?

OLE solves this ownership problem for us by providing a set of API functions to allocate, manage, and free BSTRs. Therefore, programmers have to remember only one simple rule: The calling object allocates memory for the string by calling SysAllocString, and the receiving object calls SysFreeString when it is done using it. These are both Windows API functions defined in OLEAUT32.DLL.

OLE AUTOMATION COLLECTIONS

With that whirlwind introduction out of the way, we arrive at the primary focus of this article: OLE Automation Collections. As I hinted earlier, an Automation Object must support the IEnumVariant interface to allow an Automation controller that supports the For Each . . . In . . . syntax to iterate over the individual elements in the Collection. IEnumVariant is implemented by an enumerator object. Enumerators, which are independent objects created by a Collection object, allow the Automation Controller to step through the elements of the Collection. Let's take a look at the member functions of IEnumVariant. The key functions of IEnumVariant are Reset and Next. Reset simply resets the enumerator object to the start of the collection, and Next returns the next *n* elements from the collection.

It is the responsibility of the Collection object to return a pointer to its enumerator object's IUnknown interface when asked to do so by an Automation Controller. So how does an Automation Controller ask a Collection for an enumerator? It does so through a special reserved DispID for an Automation property called _NewEnum. Since the Automation Controller will always call _NewEnum by using a DispID of -4, what the _NewEnum property is called is not particularly important.

When an Automation Object receives a read request for _NewEnum, it constructs a new instance of the enumerator object and returns a pointer to the enumerator's IUnknown interface. The Automation Controller then calls the enumerator's QueryInterface function to request an IEnumVariant interface. Upon obtaining the pointer to the IEnumVariant interface, the controller must

THE FUNCTIONS OF IENUMVARIANT

Function	Description
Next	Return the next *n* elements in the Collection.
Skip	Skip the next *n* elements in the Collection.
Reset	Reset enumerator to the start of the Collection.
Clone	Create a copy of the current enumerator and its state.

FIGURE 4: *The IEnumVariant interface and its functions.*

```
// IEnumVariant object

// Create a new instance of the Enumerator by keeping a
// reference to the TStringList
// object that is contained in the TVBList object
constructor IMyEnumVariant.Create(pStringList: TVBList);
begin
  m_pVBList := pStringList;
  m_CurrentPosition := -1;
  FRefCount := 1;
end;

// Return the next celt elements from the Collection
function IMyEnumVariant.Next(celt: Integer; elt:
PVariantArgList; pceltFetched: Integer): HResult;
var
  hr: HResult;
  I: Integer;
  OleStr: TBStr;
begin
  // Validate the arguments from the controller
  pceltFetched := 0;
  if pceltFetched <> 0 then
    pceltFetched := 0
  else if celt > 1 then begin
    Result := E_INVALIDARG;
    Exit;
end;

// Initialize the Variant Array
for I := 0 to celt - 1 do
  VariantInit(Variant(elt^[I]));

hr := S_OK;

// Now attempt to return the number of elements that
// was requested
for I := 0 to celt - 1 do begin
  if m_CurrentPosition < m_pVBList.Count then begin

    m_pVBList.SetIndex(m_CurrentPosition);
    OleStr := StringToOleStr(m_pVBList.GetCurrent);
    PVarData(@elt^[I])^.VType := varOleStr;
    PVarData(@elt^[I])^.VOleStr := OleStr;

    Inc(m_CurrentPosition);
    Inc(pceltFetched);
  end
  else
    hr := S_FALSE;
end;

Result := hr;
```

(continued)

FIGURE 5: *The implementation of IEnumVariant.*

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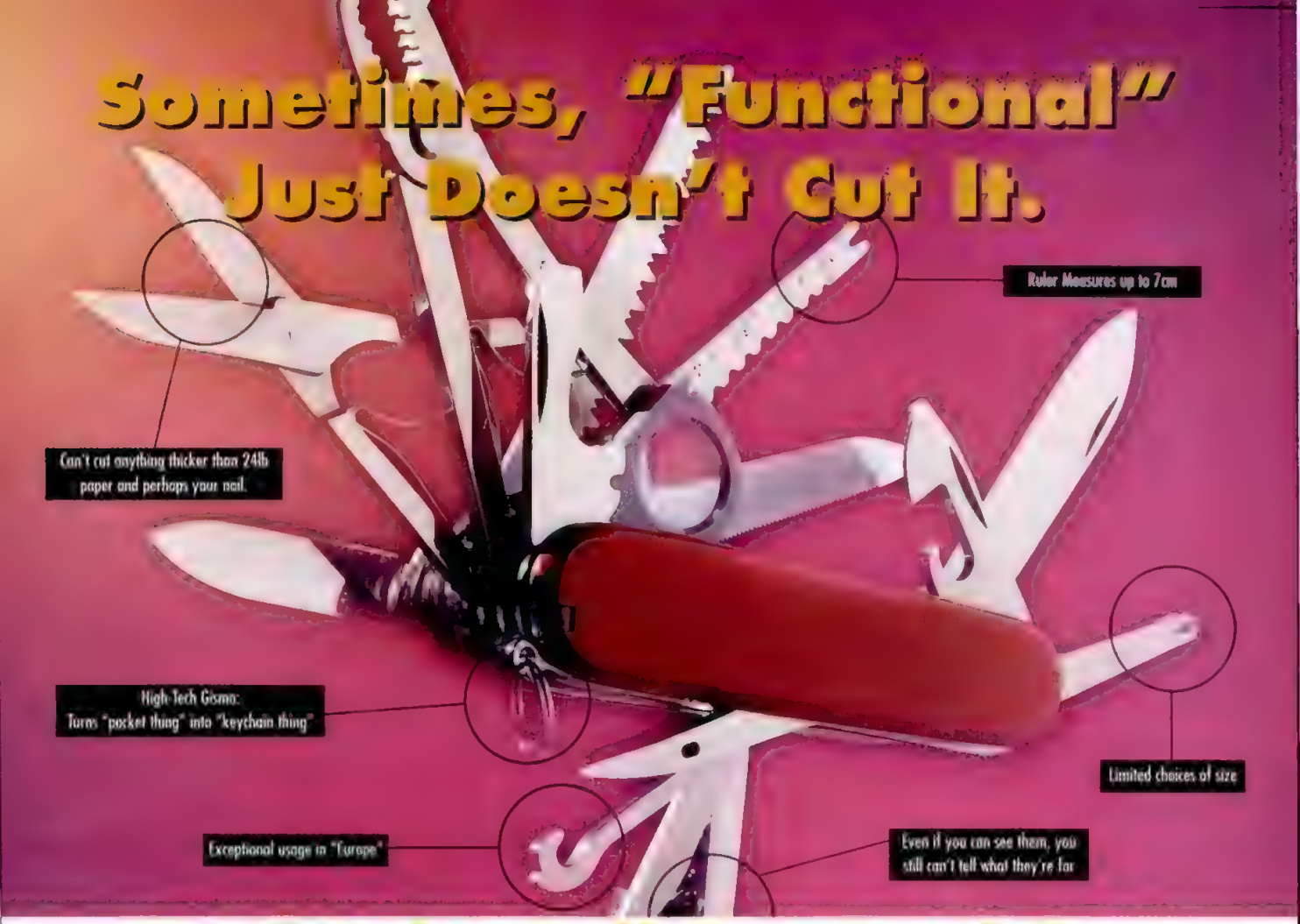

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```
end;

function IMyEnumVariant.Skip(celt: Longint): HResult;
begin
end;

// Reset the current position in the list to the start of
// the list
function IMyEnumVariant.Reset: HResult;
begin
  m_CurrentPosition := 0;
  Result := S_OK;
end;

function IMyEnumVariant.Clone(var enum: IEnumVariant):
HResult;
begin
end;

// Standard IUnknown interface implementation
function IMyEnumVariant.QueryInterface(const iid: TIID;
var obj): HResult;
begin
  if IsEqualIID(iid, IID_IUnknown) or IsEqualIID(iid,
  IID_IEnumVariant) then begin
    Pointer(obj) := Self;
    AddRef;
    Result := S_OK;
  end
  else begin
    Pointer(obj) := nil;
    Result := E_NOINTERFACE;
  end;
end;

function IMyEnumVariant.AddRef: Longint;
begin
  Inc(FRefCount);
  Result := FRefCount;
end;

function IMyEnumVariant.Release: Longint;
begin
  Dec(FRefCount);
  Result := FRefCount;
  if FRefCount = 0 then Free;
end;


  // My declaration of the IEnumVariant interface
  IMyEnumVariant = class(IUnknown)
    constructor Create(pStringList: TVBList);

    // Standard IUnknown interface functions
    function QueryInterface(const iid: TIID; var obj):
    HResult; override;
    function AddRef: Longint; override;
    function Release: Longint; override;

    // IEnumVariant interface functions
    function Next(celt: Integer; elt: PVariantArgList;
    pceltFetched: Integer): HResult; virtual; stdcall;
    function Skip(celt: Longint): HResult; virtual;
    stdcall;
    function Reset: HResult; virtual; stdcall;
    function Clone(var enum: IEnumVariant): HResult;
    virtual; stdcall;
  private
    m_pVBList: TVBList;
    m_CurrentPosition : Integer;
    FRefCount: Integer;
```

FIGURE 5 (cont.)

call the Release function for the IUnknown interface, since it has no use for the IUnknown interface anymore. It is very important for an Automation Controller to call Release, because the enumerator will not destroy itself until its reference count reaches 0.

The Automation Controller then repeatedly calls the Next function of the enumerator's IEnumVariant interface as long as it receives S_OK as the return value. Each Variant that it receives from the Next function is assigned to the Element parameter in the For Each Element in Collection loop. The Variant that it receives can contain data, or it can be another Automation object. How? There is a special type of Variant that contains an IDispatch pointer.

If VBA calls an Automation object and receives a Variant that contains an IDispatch pointer, it will treat the Element parameter as another object variable. This lets the Collection designer create Collections of Automation Objects. An example is Microsoft Excel, which manages Collections of Worksheet objects in the WorkSheets Collection.

An Automation Controller is finished with the enumerator object when the Next function returns S_FALSE. When this happens, it calls the Release member function of IEnumVariant, which destroys the enumerator object if its reference count reaches 0. Now that we know the life cycle of an enumerator object, let's take a look at how to create one.

DELPHI 2.0 AND CREATING AUTOMATION OBJECTS

Delphi 2.0 is the new 32-bit version of Delphi. Among its many enhancements is support for OLE Automation, both as a Controller and as a tool for creating Automation Objects. Creating an Automation Object in Delphi 2.0 is extremely easy, and to illustrate this I will show you how to port the linked-list object that we created in Visual C++ 4.0 to Delphi 2.0.

To create an Automation object, simply derive a new class from TAutoObject. A segment of the code from the new linked-list object is shown below:

```
type
  TVBList = class(TAutoObject);
automated
  property _NewEnum: Variant read
  ➡GetNewEnum dispid -4;
  procedure AddHead(const S: String);
  function GetNext: String;
  ...
end;
```

All declarations of methods (procedures and functions) and properties that follow the new *automated* directive are exposed as Automation methods and properties. Remember how all Automation parameters are passed between the Automation Controller and the Automation Object as Variants? Delphi takes care of converting between Variants and native Delphi data types, before and after calling your object's methods and properties. You, the developer, write the Automation methods and functions exactly the same way as you would write methods and functions for any other object. This is a much more elegant

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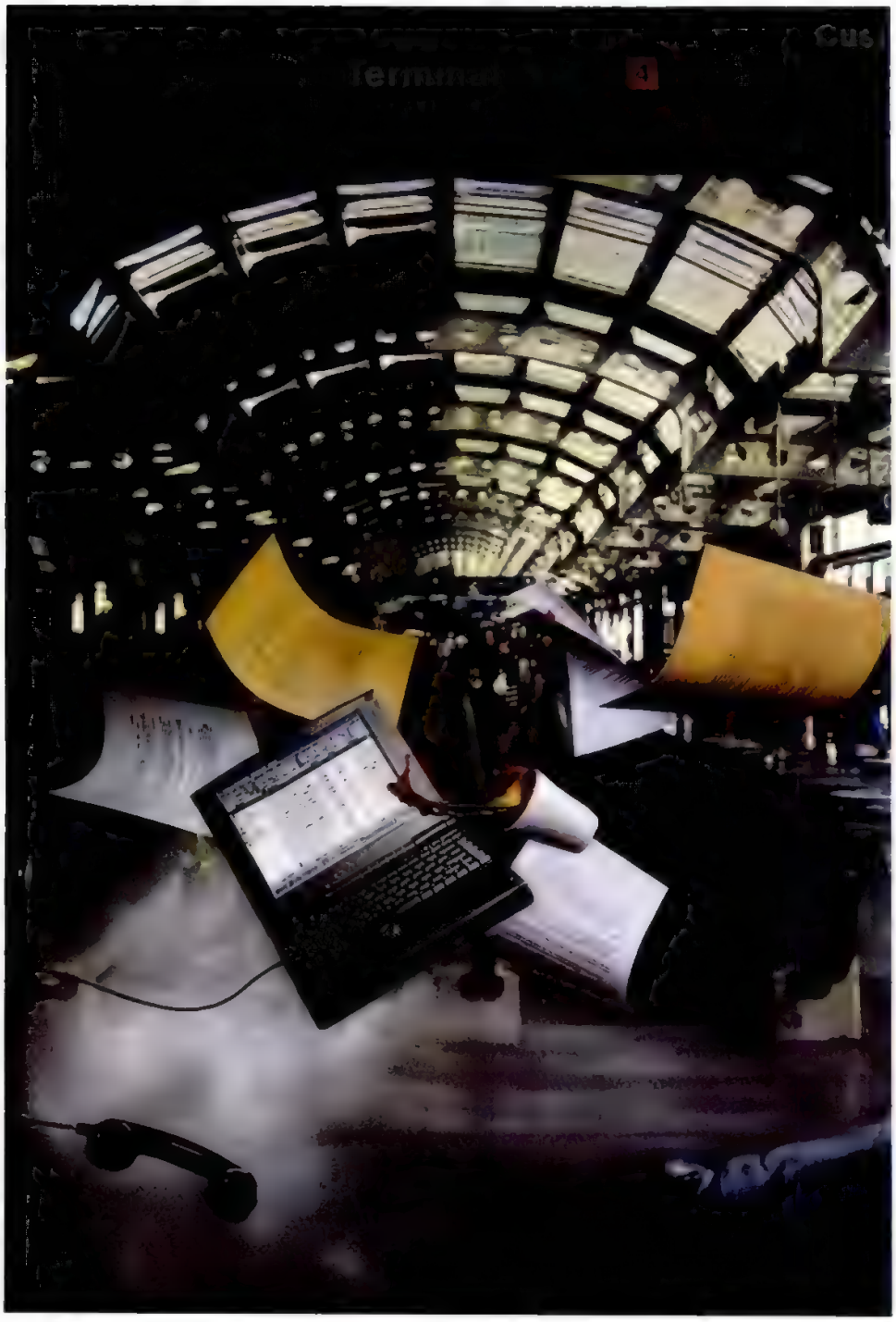

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```
Private Sub Command1_Click()
  Call tmAddToList(CStr(Text1.Text))
  Text1.Text = ""
  Text1.SetFocus
End Sub

Private Sub Command2_Click()

  Dim objListReference As Object, i%

  ' Get a reference to the module's string list
  Set objListReference = tmGetList()

  List1.Clear

  ' Now operate on that reference to put elements into
  ' the list box
  For Each Element In objListReference
    List1.AddItem Element
  Next

End Sub

Dim m_StringList As Object
Sub Main()

  ' Create the persistant list object
  Set m_StringList = CreateObject("VBLIST.VBList")
  frmTest.Show 1

  Set m_StringList = Nothing

End Sub
Sub tmAddToList(strValue$)

  m_StringList.AddTail (strValue)

End Sub
Function tmGetList() As Object

  ' Return a reference to the stringlist object

  ' This is not what you would like to do in practice,
  ' but it is a nice
  ' illustration of how you can pass around the
  ' stringlist object as a
  ' parameter in function calls.
  Set tmGetList = m_StringList

End Function
```

FIGURE 6: *A sample VBA application that uses the For Each Element in Collection syntax.*

solution to the parameter conversion problem than the macros and Class Wizard invocations used to achieve the same result in MFC (Microsoft Foundation Classes).

What about the linked list itself? Recall from my previous column that we used the CStringList object in MFC to implement the linked list. This simplified the project to an exercise in writing an Automation wrapper class for CStringList. Delphi has a similar "list" object called TStringList, but it is not a linked list—rather, it is an array that has an insert function. For simplicity, I chose to keep the interface functions for the Delphi VBList object the same as those for the C++ VBList object. Keep in mind, however, that the performance of the Delphi VBList object during insertions will not be on a par with the C++ VBList object, because one is an array and the other is a linked list.

IMPLEMENTING AN IENUMVARIANT INTERFACE

Creating the enumerator object is also quite straightforward. First we derive the IEnumVariant interface from IUnknown. The code for doing this is shown in Figure 5.

Next we provide our own implementation for the standard IUnknown interface member functions AddRef, Release, and QueryInterface by overriding the abstract function declarations in IUnknown. Following these functions are the virtual IEnumVariant functions. The order of declaration of all the interface functions is critical, because all the functions will be called through offsets into the interface's v-table by the Automation controller. You can find all the COM interfaces quite thoroughly documented in the OLE SDK documentation or in the OLE2.INT file included in the Delphi documentation.

How does the enumerator object come into existence? Recall that the _NewEnum property is read by the Automation Controller. We declared this property using the *dispid* directive to force its DispID to be -4. The piece of code that gets executed is the GetNewEnum function:

```
function TVBList.GetNewEnum: Variant;
begin
  // Create the object on the fly
  FEnumVariant :=
  ➥IMyEnumVariant.Create(Self);
  VarClear(Result);
  TVarData(Result).VType :=
  ➥varUnknown;
  TVarData(Result).VUnknown :=
  ➥FEnumVariant;
  FEnumVariant.Reset;
end;
```

This function constructs a new enumerator object on the fly and passes its constructor a reference to the VBList object. GetNewEnum returns a pointer to the IUnknown interface of the newly created enumerator object and Resets the enumerator to point to the start of the list. The Create constructor for IMyEnumVariant sets a pointer to point back to the VBList object and initializes the enumerator's reference counter to 1.

Let's examine the enumerator object's reference-counting functions, AddRef and Release. AddRef simply increments the enumerator's reference count and returns the new reference count. Release decrements the enumerator's reference count, then checks to see if the reference count has dropped to zero. If it has, then it calls its own "free" method to destroy itself.

QueryInterface requires a closer look. The enumerator object implements both IUnknown and IEnumVariant interfaces through the same set of functions. Therefore, the QueryInterface function checks the iid, or interface ID, to see if the calling object is requesting an IUnknown or IEnumVariant interface. If either interface is requested, the enumerator returns a pointer to itself and increments its own reference count. If any other interface is requested, the enumerator informs the calling object that the interface doesn't exist by returning a E_NOINTERFACE error.

NEXT!

The most important function in the IEnumVariant interface is the Next function. This is the function that is repeatedly called by the Automation Controller for successive elements in the Collection. The Automation Controller can request one or more elements from the Collection, and it is the job of the Next function to return the requested number of elements in the Variant array parameter "elt"—if it can. If there aren't enough elements left in the Collection to fulfill the requested number of elements, we return all that we can and set the pceltFetched para-

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meter to the actual number of elements returned. In the event that there are more elements in the Collection, we return S_OK; otherwise we return S_FALSE to signal that we are at the end of the Collection.

Let's focus on how the Next function gets the data out of the VBList object. It maintains the current index into the VBList object in the m_CurrentPosition variable. So to get the current element from VBList, it sets the current position of the VBList object by calling the SetIndex function of VBList and calls the GetCurrent member function to actually retrieve the string. Remember that we need to convert all string parameters to BSTRs. The call to the StringToOleStr function performs this conversion. The next two statements set the Variant up as a BSTR Variant by pointing the VOleStr field of the Variant to the BSTR that we just created.

TESTING OUR OLE AUTOMATION OBJECT

Now that we have created our VBList Automation Collection object, we can write a simple test application. Figure 5 shows a simple VB4 application that adds several elements to the VBList object and then dumps the contents of the VBList object into a list box control using the For Each Element in Collection syntax.

This shows a very simple use of the VBList control. I'm sure that you'll find other creative ways of extending the control. For example, you could turn it into a stack or a queue object with minimal modifications. I recently used a variant of the VBList control as an internal stack for a code profiler that I wrote for Visual Basic.

The VBList Object that we have created is a simple example of how to create an OLE Automation Collection object for use in VBA Automation Controllers. I have given you a behind-the-scenes look at the mechanics of OLE Automation Collections and have shown you how Delphi 2.0 provides a convenient framework that makes creating an Automation Object as easy as creating any other object in Delphi. Finally, the addition of our IEnumVariant interface support shows you how you can adapt your Automation Objects to take advantage of the features provided by the Automation Collection standard. □

FOR FURTHER READING:

Kraig Brockschmidt, *Mastering OLE*, Microsoft Press, 1995.
John Toohey, *Using OLE 2.x in Application Development*, Que Press, 1994.
Bryan Waters, *Mastering OLE2*, Sybex, 1995.

John Lam is the director of software development for Continuum Research, a company that specializes in creating OLE- and OCX-based tools for developers.

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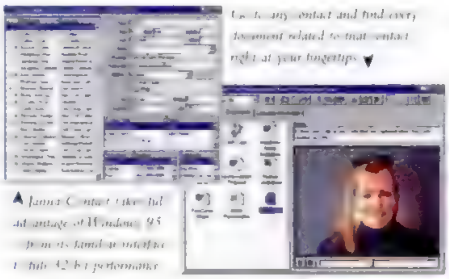

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T2130CS	486DX2-50	4MB	330	10.4" D/S Color	$1099
T2110CS	486DX4/75	4MB	330	10.4" D/S Color	$1199
T2130CT	[illegible]	8MB	500	10.4 Act Color	$1888
T2150CDS	486DX4/75	4MB	500	10.4 D/S Color	$1799
T2150CDT	486DX4/75	8MB	500	10.4 Act Color	$2499
T2450CT	486DX4/75	8MB	520	9.5 Act Color	$3299
T610CT	PENTIUM 90	8MB	720	9.5 Act Color	$3399
T400CDT	PENTIUM 75	8MB	810	10.4 Act Color	$3549
T400CS	PENTIUM 75	8MB	810	10.4 D/S Color	$2299
T410CS	PENTIUM 90	8MB	810	11.3" D/S Color	$3099
T410CT	PENTIUM 90	8MB	810	11.3 Act Color	$3749
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950N P75CT	PENTIUM 75	8MB	800	10.4 ACT Color	$2899
950N M90	PENTIUM 90	8MB	1.2G	10.4 D/S Color	$2999
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420CX	486DX4-75	8MB	420	10.4 Active Color	$1849
430CX	486DX4-100	8MB	720	10.4 Active Color	$2399
TE5000	Pentium 75	8MB	510	10.4 D/S Scan	$3297
TE5000	Pentium 75	8MB	810	11.3 D/S Scan	$3999
TE5000	Pentium 75	8MB	810	10.4 Active Color	$4349
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4050C	PENTIUM 90	8MB	720	10.1" ACT Color	$3199
4050H	PENTIUM 90	8MB	810	10.4" Act Color	$3999
4080H	PENTIUM 120	8MB	1.0G	10.4" Act Color	$4199
2000D	486DX-75	4MB	340	9.5 D/S Color	$4699
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560CDT	PENTIUM 75	8MB	1.2G	10.4 Act Color	$3299
TM5000	PENTIUM 75	8MB	524	10.5 D/S Color	$2299
TM5000	PENTIUM 75	8MB	810	10.4 Act Color	$2599
TM5100	PENTIUM 90	8MB	1.2G	10.4 Act Color	$3099
TM5200	PENTIUM 120	8MB	1.2G	10.4 Act Color	$4599

Canon

MODEL #	PROCESSOR	RAM	HD	DISPLAY	PRICE
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NotE 100	486DX4/100	8MB	810	10.4 D/S Color	$2499
NotEMCX	PENTIUM 90	8MB	810	11.8 ACT Color	$4599
NotEMCX	PENTIUM 120	8MB	1.2G	11.8 ACT Color	$5499
LS200	486DX2-66	4MB	340	11.3 D/S Color	$1299
LS200	486DX4-100	8MB	510	11.3 D/S Color	$1699

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MODEL #	PROCESSOR	RAM	HD	DISPLAY	PRICE
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760C	Pentium 90	8MB	720	12.1 Active Color	$5299
760C	Pentium 120	8MB	720	12.1 Active Color	$5699
760CD	Pentium 90	8MB	1.2G	12.1 Active Color	$5899
760CD	Pentium 120	8MB	1.2G	12.1" Active Color	$5999
765CX	Pentium 75	8MB	810	10.4" Active Color	$6799
765CX	P-75 W/CD	8MB	540	10.4" Active Color	$3499
701C	486DX/50	8MB	540	10.4" Active Color	$2099
701C	486DX-75	8MB	540	10.4 Active Color	$2399
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701CS	486DX-75	8MB	540	9.5 Dual Scan	$2299
765	486DX4-75	8MB	540	10.4 Dual Scan	$1639
765	486DX4-75	8MB	340	10.4 Active Color	$1999
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By Michael J. Mefford

A Bitmap Photo Album

PicAlbum finds and organizes all the bitmaps on your hard disk.

How many bitmap files are scattered around your hard disk? You'd probably be surprised at the number. This issue's utility, PicAlbum, finds all the bitmaps, displays them, and lets you organize them into picture albums. The bitmaps are not actually moved; the albums use references to the bitmaps on your disk. Knowing what your bitmap files look like and where they are located makes it easier to incorporate them into documents you create. The bitmap file types that PicAlbum supports are .BMP, .DIB, .PCX, .GIF, TIFF, and Targa.

You can obtain PicAlbum by downloading it from PC Magazine Online or through the mail. (Refer to the sidebar "Guide to Our Utilities" for details.) The source code for PicAlbum, which was written in Borland's visual programming tool, Delphi, is also provided for those interested in seeing how it works.

USING PICALBUM

PicAlbum consists of two program files (PICALBUM.EXE and PICALBUM.HLP), an .INI file that is automatically created when you run PicAlbum, and four support files (BIVBX11.DLL, IKDSP16.VBX, IKEND16.DLL, and IKCOL16.DLL). The support files that start with IK are from a third-party VBX component called ImageKnife, from Media Architects. ImageKnife gives PicAlbum the ability to display all the different bitmap file formats mentioned above. The component has other capabilities as well, but these were not needed for PicAlbum.

We chose to use ImageKnife in PicAlbum because developing the capability from scratch would have been pointlessly time consuming. Since the capability was readily and inexpensively available from a third party, there was no point in reinventing it.

The easiest way to install PicAlbum is to copy the program files and support files to a directory on your hard disk. This method will always work, but you may want to put the ImageKnife support files in the Windows SYSTEM directory, where other programs can share them. If you choose to do this, be aware that you may already have some or all of these files on your system, and the versions you have may be newer. Check the files' dates before copying over them, and don't overwrite newer versions with older versions. If you have any doubt and want to be safe, simply place the ImageKnife files in the same directory as PICALBUM.EXE.

When you've copied all the files to your hard disk, place PicAlbum's icon in the folder of your choice and double-click on the icon to launch the program. The PicAlbum interface is divided into four quadrants (Figure 1). The list of albums you create is displayed in the upper-left quadrant. The bitmaps in the highlighted album are displayed in the upper-right quadrant. The lower quadrants show you the bitmaps that exist on your hard disk. The directories you select to search are displayed in the lower-left quadrant; the bitmaps contained in those directories are displayed in the lower-right quadrant.

IN THIS ISSUE

PicAlbum

*PicAlbum finds all the bitmaps on your hard disk, displays them, and lets you organize them in picture albums without changing their locations on **your disk.** PicAlbum supports .BMP, .DIB, .GIF, TIFF, **and Targa** file types*

To create an album, click on the leftmost button above the Albums list or select File | New Album. (Note that if you place the mouse cursor over a button, flyover help will appear with a description of the button.) A dialog box will prompt you for the name of your album. Type in a descriptive name, such as "PCX bitmaps" or "Bitmaps of telephones." You do not have to use a DOS-style filename since album information is stored in PicAlbum's .INI file, not in a separate album file.

Next, select which directories to search for bitmaps by clicking on the leftmost button above the Directories list box or by selecting File | Select Directories. This will bring up the Bitmap Directories dialog box (see Figure 2).

The Bitmap Directories dialog box lets you build a list of directories to scan for bitmaps. To find all the bitmaps on a particular disk drive, select the disk drive in the Drives combo box, highlight the root directory in the Directory To Add list box, make sure Include Subdirectories is checked, and click the Add button. All the directories on the drive will be added to the Directories to Scan list box.

You can add directories from another drive to the list by selecting the drive, highlighting the directory, and pressing Add. If the Include Subdirectories box is checked, all directories below the selected directory will be added as well.

To selectively remove a directory from the list, highlight the directory, then click Remove or press the Delete key. To clear the list and start over, press the Clear button. The check boxes at the bottom of the Bitmap Directories dialog box let you select the types of bitmaps to scan for.

When you have finished building your Directories to Scan list and have checked the bitmap types you want to include, click the OK button to return to the main window. The directories you selected will appear in the Directories list box in the lower-left quadrant. To begin scanning, click the right-arrow button above the Directories list box or select File | Find Bitmaps from the menu. When scanning is complete, all the bitmaps in the selected directories of the types you specified will appear in the Directory Bitmaps list box in the lower-right quadrant.

You can review the bitmaps by scrolling down through the list. A reduced, thumbnail view of the highlighted bitmap file will appear to the right of the list box. If you want a better look, there are many ways to do it: Double-click on the thumbnail, click the magnifying glass button above the Directory Bitmaps list box, select File | View Directory Bitmap, or press Enter or double-click on a bitmap filename.

While viewing a full-size bitmap, you can press the PgUp or PgDn keys to see the next bitmap in the list without having to return to the main window to select a new bitmap. Pressing the cursor arrow keys (left, right,

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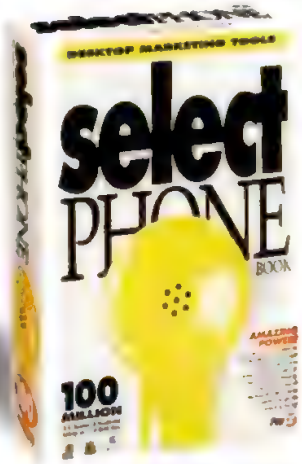


PICK YOUR TARGET. Are you looking for all the florists in Seattle? All the plumbers within ten miles of your office? The nearest 200 auto body shops? Every bakery in your ZIP code? No problem. They're all on Select Phone's 6 CD-ROMs. And finding them is a piece of cake. Because unlike your local phonebook, Select Phone lets you drill down through *every published listing* in the U.S. So you can look up all *100 million listings* any way you want. By name, street address, city, state, ZIP code, phone number or business heading. And get this – you can even find potential new customers based on their *exact distance* from your home or office. Listen to how three businesses use Select Phone every day to find new customers.

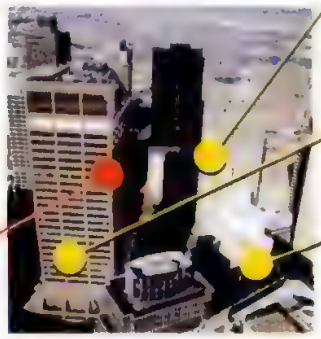
1 GeoTarget™ or *"Give me the nearest"*

A SELECT PHONE EXCLUSIVE. *Find listings based on their distance from your home, office, or any point you choose.* Meet Brian Goodro, Sales Manager at Thomas Ford in Beverly, Massachusetts. Brian uses Select Phone's GeoTarget feature to help sell vans. His first move is to target plumbers, likely prospects to buy a new van. So Brian opens

Select Phone, clicks on the Business Heading field, and pulls up *PLUMBERS.* Next he uses the GeoTarget feature to narrow his search to "all the plumbers within 10 miles," (or he could ask for the 200 closest plumbers – the choice is his). Now Brian has an instant, targeted list, ready to export to his word processor for a fast and effective direct mail or telemarketing program.

2 Street-smart marketing – or *"Give me all the neighbors"*

The Select Phone way to canvas the neighborhood. Brenda Jackunas is a franchise owner of Windsor Chem-Dry, an Oriental and area rug cleaning shop. Brenda likes to build her business using customer referrals. First she looks up a current customer in Select Phone. Tags it. Then she hits the little red door "Neighbor" button. Within seconds, Select Phone generates a prospect list of her customer's neighbors, the people living on the same street. (She can also use this feature to create a list of all companies within the same office building!) Armed with this list, Brenda gets the customer's permission to have their neighbors drop by and see her company's work. Talk about micro marketing! Who better to sell for you than your own customers. But does it really work? In Brenda's words, "Very successfully!"



Type in the street address and find all the businesses in this building.

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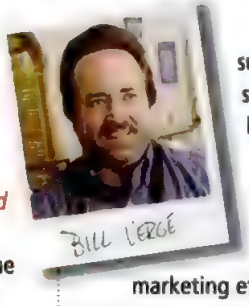

Select Phone comes with unlimited downloading and unlimited use. Bill Vergé designs, creates and sells the gold and platinum jewelry you'll find in his Scituate store. Like many successful small business owners, Bill must rely on his own marketing efforts to build his business. It's all up to him. So when he's not at his work-bench, Bill's at his computer. After 17 years as a retailer, Bill knows he needs to do at least four mailings a year – 10,000 pieces at a time – to generate decent store traffic. No small investment for any business. After years of renting expensive lists he could only use once, Bill discovered Select Phone. Now he creates his own instant, ready-to-mail lists, saving him the cost, time and aggravation of renting them from a broker. And better yet, Bill is now free to use any or all of Select Phone's 100 million listings as often as he wants.

Select Phone gives you unlimited access to all 100 million listings for your personal use. (Other Phonebooks on CD-ROM limit you to a mere 5,000.)

4 PC World picks Select Phone 1996 Best Buy among all CD-ROM Phone Directories!

"...(PC World) focused on accuracy, ease of use, and search-and-retrieval capabilities. The Best Buy goes to Select Phone for excellence in all three categories. ...its 89 percent accuracy rating surpassed all the other directories'. Extensive search capabilities and a long list of export file formats put it over the top."

– PC World, February 1996

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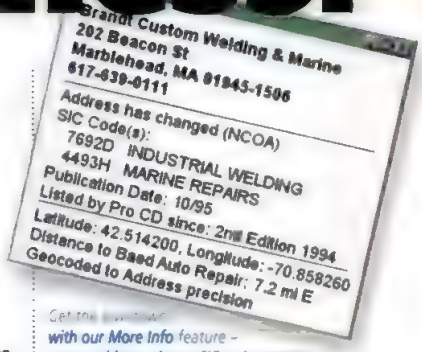

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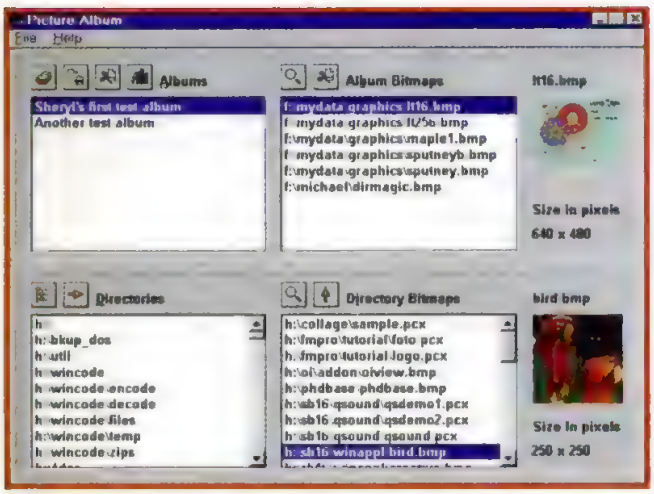

FIGURE 1: *PicAlbum's top two list boxes show your albums and the bitmaps they contain. The bottom two list boxes show the bitmaps available on disk.*

up, and down) will scroll any bitmap that is too large to fit on the screen. Any other keystroke or mouse click will take you back to PicAlbum.

When you see a bitmap that you want to place in an album, first make sure the album you want to place it in is highlighted in the Albums list in the upper-left quadrant. You can then add the highlighted bitmap to the album in several ways: Click the up arrow located above the Directory Bitmaps list box, select File | Add Bitmap to Album from the menu, or use drag-and-drop. You can drag the selected bitmap(s) from the Directory Bitmaps list box or drag the thumbnail of the selected bitmap. And you can drop your dragged bitmap(s) into the Album Bitmaps list box or onto the desired album name in the Albums list box. Note that PicAlbum doesn't actually move the bitmap files but rather stores the path to the bitmap files, so you don't have to worry about dislocating bitmaps used by other programs.

Once you have added bitmaps to albums, there are two images on the main screen at once. Only one of them can have control of the palette—the set of colors Windows uses to display the bitmap. If both are 256-color images and their palettes are very different, the one that's not active can look pretty bad. Just click on it or on the associated list box to activate it.

To remove bitmaps from an album, first highlight the bitmap(s). Then press Delete, click the button with the scissors over the Album Bitmaps list box, or choose File | Remove Album Bitmap from the menu. Similarly, to delete albums, first highlight the album(s). Then press Delete, click the button with the scissors over the Albums list box, or choose File | Delete Album from the menu. Deleting a bitmap from an album doesn't delete the actual bitmap; it merely removes the pointer to that bitmap from PicAlbum's .INI file.

You can rename albums in any of three ways: double-click on the album name, highlight the album and select the rightmost button over the Albums list box, or select File | Rename Album from the menu.

To save your album changes, click the second button from the left above the Albums list box or select File | Save Albums. If you attempt to exit PicAlbum without saving your changes, PicAlbum will ask you if you want to save before exiting.

PICALBUM INNARDS

PicAlbum is essentially a database program that uses its .INI file to house its data—the names of your albums and the bitmaps they contain. When PicAlbum is launched, the album names are read from the .INI file into a list box.

Delphi list boxes can associate an object with each item in the list. PicAlbum takes advantage of this feature to associate a list of bitmaps with each album. You can see how this is done in PicAlbum's NewAlbumNameClick procedure (Figure 3). When a user creates a new album, the first thing PicAlbum does is to create a TStringList object called Alist for future storage of bitmap filenames. The new album name and its associated object, the string list, are added to the Albums list box's Items property. PicAlbum then sets the list box's ItemIndex property to the index of the last item (the newly added album name) so that it will be highlighted. The last index is one less than the number of items because indexes start at zero.

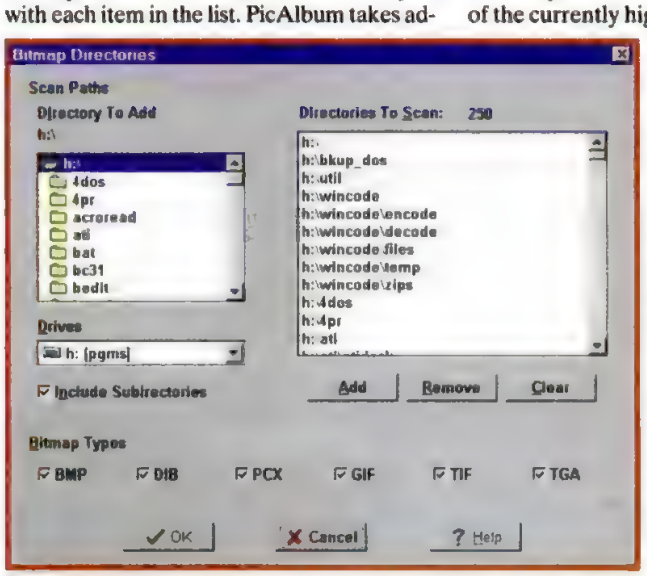

FIGURE 2: *The Bitmap Directories dialog box lets you select which drives and directories to scan for bitmaps.*

Next, PicAlbum calls its UpdateAlbums procedure to update the Album Bitmaps list box (Figure 4). The UpdateAlbums procedure has two main tasks. First, it stores the filenames from the previously highlighted album (the names previously displayed in the Album Bitmaps list box) in the TStringList object associated with that album in the Albums list box. Second, it loads the Album Bitmaps list box with the filenames stored in the TStringList object associated with the newly highlighted item in the Albums list box. Both these tasks are accomplished using the Assign method.

The Assign method of a TStringList object copies strings from a source list to a destination list. The syntax is Destination.Assign (Source), which means it's the Destination object's Assign method that is responsible for the copying. The two statements look like simple inverses of one another, but they differ in the index used to access the Albums list box object. AlbumsIndex is an index maintained by PicAlbum that stores the index of the last album highlighted. ItemIndex is maintained by the list box, and it stores the index of the currently highlighted album.

Thus, the first Assign statement in the UpdateAlbums procedure stores the old AlbumBitmaps filenames. The Albums list box object must be typecast to a TStringList type, because the Objects array property of a TStringList simply stores pointers, without any information about the data type they point to. The second Assign statement copies the filenames associated with the newly highlighted album to the Album Bitmaps list box.

After the two transfers, PicAlbum updates the AlbumsIndex by assigning it to the new ItemIndex, then calls UpdateAlbumBitmaps. This last procedure loads the thumbnail with the highlighted bitmap.

UpdateAlbums is called not only when the user creates a new album, but also whenever the user selects a different album. Detecting when a different album was selected involves a small trick. Several components have an OnChange event that is triggered when the

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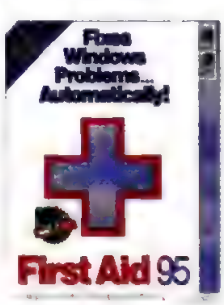

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```
procedure TMainForm.NewAlbumNameClick(Sender:
TObject);
var
  AList : TStringList;
begin
  if NewAlbum.ShowModal = mrOK then
  begin
  with Albums do
    begin
      AList:= TStringList.Create;
      Items.AddObject(NewAlbum.EditName.Text, AList);
      ItemIndex:= Items.Count - 1;
      UpdateAlbums;
      Modified:= true;
    end;
  end;
end;
```

FIGURE 3: *When the user creates a new album, PicAlbum creates a TStringList for bitmap filename storage and adds this to the Albums list box along with the new album name.*

component's selection changes, but list boxes have only OnClick. OnClick is triggered by a mouse click or keyboard equivalent whether or not the selection actually changes. PicAlbum gets the equivalent of an OnChange event by storing the previous value of ItemIndex in AlbumsIndex and taking action in the OnClick event handler only when ItemIndex has changed:

```
procedure
TMainForm.AlbumsClick(Sender:
TObject);
begin
  if AlbumsIndex <> Albums.ItemIndex
then
  begin
    UpdateAlbums;
    with AlbumBitmaps do
    if Items.Count > 0 then
      Selected[0]:= true;
  end;
end;
```

Calling UpdateAlbums every time the OnClick event occurred would cause the thumbnail to be rewritten (and thus to flash) each time the user clicked on the Albums list box, even if a new album was not selected.

THE PICALBUM .INI FILE

Instead of creating a new database file format, PicAlbum uses an .INI file to store its data. I chose this method because the Windows API makes maintaining an .INI file a breeze. A limitation of .INI files is that they cannot exceed 64K, but PicAlbum's storage needs are so minimal that this is not a problem.

PicAlbum's .INI file uses three types of section headers—options, album names, and album contents. These may appear in any order in the .INI file. The two option headers are associated with the Bitmap Directories dialog box. The first, [Options], heads the section where the Include Subdirectories preference is stored. The second, [Bitmap Types], heads the section where the bitmap type selections are stored.

The [Albums] section stores the album names as keys whose values are blank. That is, the lines in the section have the form "name=", with nothing after the equal sign. The Delphi TIniFile object's ReadSection method will read all key names in a section directly into a TStringList object. Thus, storing the names as keys rather than values makes loading them into the program very simple.

For each album name in the Albums section, there is a section header of the same name. Under each album-name section header is a list of the bitmap filenames associated with the album.

As noted above, PicAlbum uses the ReadSection of a TIniFile object to fill the Albums list box. The Album Bitmaps list box is also filled by a single call to this method. Similarly, a call to the EraseSection method of the TIniFile object removes the section for a deleted album from the .INI file.

EraseSection is also used when an album is renamed. When PicAlbum renames an album, it deletes the old album, then writes the album information again under the new name. This is because neither the TIniFile object nor the Windows API functions for .INI file management support renaming headers or keys.

The process is slightly complicated by the fact that the changes to albums and their contents aren't made to the .INI file right away; changes aren't written unless the user presses the Save button or agrees to save changes when prompted on Exit. This means that PicAlbum must store all the renaming information until that time. New album names are stored in the Albums list box. PicAlbum uses a TStringList called RenamedList to store old album names. When the changes are actually saved, PicAlbum erases the sections stored in RenamedList and writes out the new ones.

PicAlbum's Directories dialog box has a Bitmap Types group box with check boxes for each file type. When the user closes the dialog box by clicking OK, the selected types are saved in the .INI file so that PicAlbum can remember the selections the next time it is run.

The state of the six check boxes could be saved with six lines of code, but an easier way is to store the check box states as elements in an array and save them by iterating over the array in a loop. Delphi makes this easy to do. The bitmap-type check boxes are stored in the Controls property of the group box that encloses them. Since the caption of each check box uniquely identifies it, saving each checked state can neatly be done with one statement:

```
with Dirs.BitmapsTypesGroupBox do
      for i:= 0 to ControlCount - 1 do
  if Controls[i] is TCheckBox then
WriteBool('BitmapsTypes',
TCheckBox(Controls[i]).Caption,
TCheckBox(Controls[i]).Checked);
```

This loop writes the state of each of the check box controls owned by the BitmapsTypes group box. Note that each element of the Controls array property must be typecast to TCheckBox in order to access its Caption and Checked properties.

IMAGEKNIFE

PicAlbum could have used the Delphi Image component to display the bitmaps. The Image component, however, has the smarts to display only the image types supported by Windows itself: .BMP, .ICO, and .WMF. To be useful, PicAlbum had to broaden its bitmap-type display capability. I wasn't about to write a

```
procedure TMainForm.UpdateAlbums;
begin
  with Albums do
  begin
    if Items.Count > 0 then
    begin

TStringList(Albums.Items.Objects[AlbumsIndex]).Assign(
        AlbumBitmaps.Items);
      AlbumBitmaps.Items.Assign(
        TStringList(Albums.Items.Objects[ItemIndex]));
    end;
    AlbumsIndex:= ItemIndex;
    UpdateAlbumBitmaps;
  end;
end;
```

FIGURE 4: *PicAlbum saves the previously highlighted album's bitmap filenames before loading the Album Bitmaps list box with the newly highlighted album's bitmaps.*

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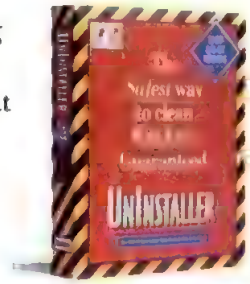

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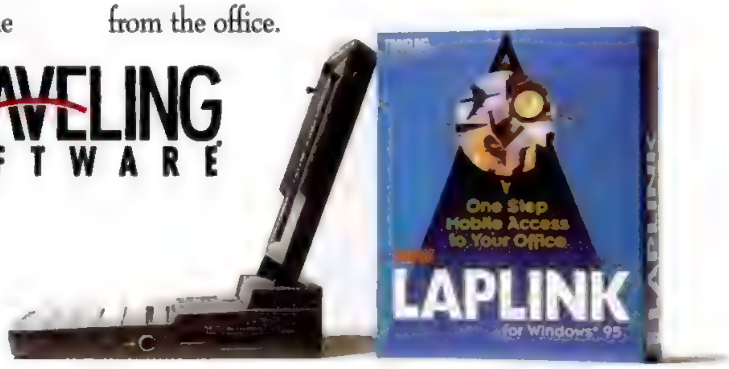

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custom component to perform this task; bitmap formats are complicated. Besides, Media Architects has a Visual Basic custom control (VBX) package called ImageKnife with the capabilities I needed.

Media Architects has granted a license to *PC Magazine* to use ImageKnife in this utility, but if you want to make changes to PicAlbum's code and recompile it, you will have to obtain the license file by purchasing ImageKnife. The Pro edition (used in this utility) costs $349. For more information, call Media Architects at 503-639-2505 (fax, 503-620-5451) or visit the company's Web site at *http://www.mediarch.com*.

ImageKnife includes support for two formats that use .LZW compression technology: .GIF and TIFF. Since Unisys Corp. holds a patent on .LZW compression, you must obtain an additional license from Unisys before Media Architects will release the code that enables use of these formats. You can contact Unisys through its Web site at *http://www.unisys.com*.

Although native Delphi components are not VBXs, you can use VBXs in Delphi programs. Delphi automatically generates code to create a "wrapper" component for a VBX; Delphi programs access the VBX through this component. You install a VBX on the component palette by selecting Options | Install Components. The Install Components dialog box has a special VBX button for file selection. Other than that, VBX installation is as seamless as it is for any Delphi component. Once you select the component and click OK, the new component is added to the Component Palette, ready for use.

To load a bitmap into a Delphi Image component, you call its Picture property's LoadFromFile method with the bitmap filename as the argument. ImageKnife's VBX component, called PicBuf, works a little differently but is just as easy. First you assign the bitmap filename to the PicBuf FileName property, then you call ikLoad with the PicBuf control as the argument:

```
AlbumPicBuf.FileName :=
AlbumBitmaps.Items[ItemIndex];
ikLoad(AlbumPicBuf.Ctl);
```

If the image loaded successfully, a call to ikSetScreenPal activates its palette.

PicAlbum uses the PicBuf component in two ways: to display thumbnails of bitmaps and to display actual-size bitmaps. To display a thumbnail, I first set the PicBuf AutoScale property to False so the image is initially at actual size. To prevent distortion should the image later need to be scaled, I set the ScaleImage and ScaleScreen properties to 1, for 1-to-1 scaling. Then I load the image into the thumbnail frame and check to see if it fits within the frame's borders. The image's size is found in the PicBuf's XResolution and YResolution properties. If it fits, then the image is displayed in the thumbnail frame as is (actual size). Otherwise, the AutoScale property is set to true and PicBuf shrinks the image to fit, using a 1-to-1 ratio. The reason I don't start off by setting AutoScale to true is to prevent small bitmaps from being stretched to fill the thumbnail frame.

> Although native Delphi components are not VBXs, you can use VBXs in Delphi programs.

AutoScale is set to false when displaying a bitmap for actual-size viewing, but the AutoSize property, which controls the size of the PicBuf image, is set to true. Thumbnails are displayed in a frame of a fixed size, but actual-size bitmaps can be any dimension. When AutoSize is set to true, the borders of the PicBuf expand or contract to fit the bitmap snugly in its actual size. You don't actually see the PicBuf border in PicAlbum, since I set the BorderStyle to 0. I didn't want a frame around the images.

Actual-size bitmaps are centered on the screen by setting the left side of the PicBuf to the result of the screen's width in pixels minus the bitmap's width, divided by 2. The top of the PicBuf is similarly set using heights instead of widths.

Some bitmaps viewed at actual size are larger than the screen. PicAlbum lets the user scroll these large bitmaps 30 pixels at a time. The scroll rate of 30 was plucked out of the air; it seemed to be a comfortable value. The scrolling procedure is called from the View form's OnFormKeyUp event. When the user presses the Up Arrow key (VK_UP), PicAlbum first checks to see if PicBuf's Top is less than zero. If true, it means PicBuf is off the top of the screen and needs to be moved down. If Top plus the ScrollRate is greater than 0—placing the PicBuf below the top of the screen—then the PicBuf Top is simply set to 0 (the top of the screen). Otherwise, the value of Top is decreased by the value of the ScrollRate. The three other arrow keys are similarly handled.

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NEW ALBUM NAME

Whenever the user is allowed to enter a value instead of picking it from a list, the application needs to look over the input carefully for errors. PicAlbum does such an inspection when the user enters a new album name. PicAlbum is concerned about four aspects of a name: that it isn't blank, that it is a unique name, that it doesn't have any leading or trailing space characters, and that it doesn't contain an equal sign.

Leading and trailing spaces are invisible, but they can cause confusion in a program by making a duplicate entry look like a unique one. Leading and trailing spaces are therefore stripped before checking if an album of the same name exists. The equal sign is an illegal character because it's used by .INI files to separate a key name from its value. If an album name is blank, is a duplicate, or contains an equal sign, the name is disallowed and an explanatory warning box is displayed to the user.

DRAG-AND-DROP

PicAlbum lets the user add a bitmap to an album by dragging a filename from the Directory Bitmaps list box to an album name in the Albums list box. During a drag event, when the cursor is over the Albums list box, its OnDragOver event handler is called. The list box will accept a drop only if it's coming from the Directory Bitmaps list box and the cursor is exactly over a name in the Albums list box.

The OnDragOver event handler's arguments include Sender (the component over which the item is dragged), Source (the component that's being dragged) and X,Y (the mouse cursor coordinates). The Accept parameter determines whether a drop would be accepted; it's true by default. If the Source is not the Directory Bitmaps list box, or if the mouse is not over an existing item in the Albums list box, then the event handler sets Accept to false. When the mouse is released, an OnDragDrop event occurs only if the most recent OnDragOver event set Accept to true.

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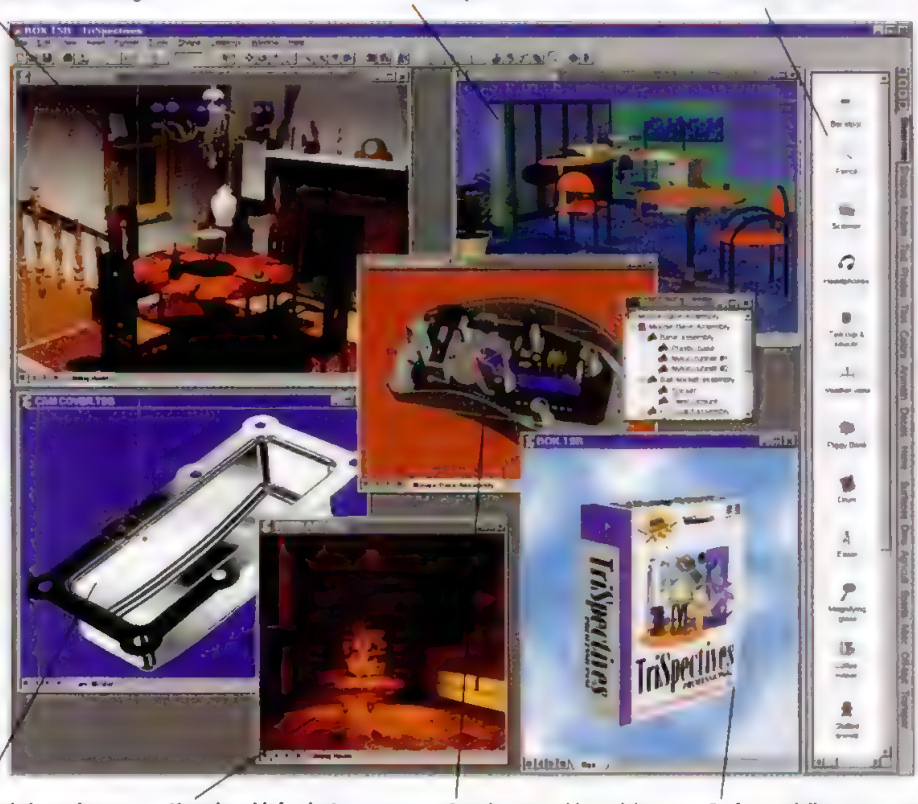

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drop functionality built in; an internal method serves to distinguish a simple mouse click from the beginning of a drag operation. Unfortunately, this drag-testing method is subverted when the OnClick handler for such a component pops up a message box. The drag-testing method doesn't get to finish until after the message box has been closed, and it erroneously detects dragging. The mouse cursor changes to indicate that a drag operation is pending, and nothing works right until you click the mouse. Ordinarily, Delphi programmers just avoid popping up message boxes in such a situation, but the error message displayed by the PicBuf control to report a file-loading problem can't be avoided. All PicAlbum can do is watch for this situation and correct it as quickly as possible. It's important that the correction occurs after the internal drag-testing method has finished but before anything else happens.

To accomplish this, PicAlbum uses a Timer component that's initially disabled by having its Interval set to 0. When a file-loading problem occurs in the OnClick handler for the AllBitmaps list box, it sets the Timer's Interval to 1, which triggers an OnTimer event as soon as the drag-testing method has finished. The OnTimer event handler sets the Interval back to zero, then stops the dragging process by calling the EndDrag method.

GET ORGANIZED

PicAlbum lets users organize the bitmaps on their hard disks by simply dragging them onto albums. PicAlbum takes care of the behind-the-scenes data management, while ImageKnife takes care of the complicated bitmap display. Using third-party components in an application can dramatically improve your application and, at the same time, reduce development time. Don't hesitate to scan development tools catalogs when you want some pizzazz in your product without the extra work.

To tell you the truth, I was quite surprised by the wealth of bitmaps on my system that I found with PicAlbum. I've got them all organized now, ready to add flair to my documents. □

Michael J. Mefford is a contributing editor of PC Magazine.

GUIDE TO OUR UTILITIES

ABOUT PICALBUM . . .

PURPOSE: PicAlbum finds all the bitmaps on your hard disk, displays them, and lets you organize them in picture albums. The bitmaps are not actually moved; the albums use references to the bitmaps on your disk. The bitmap file types PicAlbum supports are .BMP, .DIB, .PCX, .GIF, TIFF, and Targa. PicAlbum is a 16-bit Windows application that runs compatibly under Windows 95.

USAGE: To install PicAlbum, copy all its program files to a directory on your hard disk, then create an icon for PicAlbum in the folder of your choice.

To create an album, click on the leftmost button above the Albums list. A dialog box will prompt you for the name. Next, select which directories to search for bitmaps by clicking on the leftmost button above the Directories list box. This will bring up the Bitmap Directories dialog box.

When you have finished building your Directories to Scan list and have checked the bitmap types you want to include, click the OK button to return to the main window. The directories you selected will appear in the Directories list box in the lower-left quadrant. To begin scanning, click the right-arrow button above the Directories list box. When scanning is complete, all the bitmaps in the selected directories of the types you specified will appear in the Directory Bitmaps list box in the lower-right quadrant.

You can review the bitmaps by scrolling down the list. A thumbnail of the highlighted bitmap file will appear to the right of the list box. To get a better look, double-click on the thumbnail. When you see a bitmap that you want to place in an album, highlight the album, then highlight the bitmap(s) and click the up arrow above the Directory Bitmaps list box. You can also use drag-and-drop.

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PC Solutions

TIPS AND TECHNIQUES TO INCREASE YOUR PRODUCTIVITY

User-to-User

By Neil J. Rubenking

Clearing the Recent-Files List

You've probably noticed that the names of files you've just worked on appear in the last-opened files list under the File menu in most Windows applications. But do you know how to clear that list? This can be very useful if you want to hide the names of files you've just accessed. Here's how to clear that list for three common applications.

- *Microsoft Word 6.0 for Windows: After closing all your files, choose Options from the Tools menu, click on the General tab, clear the check box in front of "Recently Used File List," then click OK. Now if you look under the File menu, the list is gone. If you go back and check the box, the names of those files will not reappear. This works for Word 7 as well.*
- *WordPerfect 6.0 for Windows: Close all your files, choose Preferences from the File menu, then double-click on Environment. Under Menu, clear the box in front of "Display Last Open Filenames," click OK, and click Close. Now you're set. To start a new list, go back and check the box.*
- *Lotus 1-2-3 Release 5.0 for Windows: Exit 1-2-3 and open the file 123R5.INI in a text editor such as Notepad. The file is usually in the C:\WINDOWS directory. Under the [FILES] section, you'll see entries like the following:*

```
recfiles=3
LastOpen1=A:\123\LTSRV5.WK4
LastOpen2=A:\ LTSRV4.WK4
LastOpen3=A:\ LTSRV2A.WK4
```

Delete all the entries that start with LastOpen. Save the file and you're done. 1-2-3 will build new entries next time you start it.

LUCY CHAN, *Brooklyn, New York*

PC MAGAZINE: Most major Windows applications offer a recent-files list, sometimes called an MRU (most recently used) list. Some of them provide an option or preference setting that will clear the list, while others require .INI file editing. If you're not sure how to apply this tip to an application, first search its Help for topics such as files, file list, or recent files.

If that doesn't help, open the application, note one of the names from the list, and close it again. Open the application's .INI file in Notepad or another plain text editor and search for the filename you noted. Chances are good you'll find a series of entries similar to those described above for Lotus 1-2-3—delete them and your secrecy is assured. Now if the boss borrows your system, she won't find RESUME.DOC or EMBEZZLE.WK4 in the list of recently used files!

Windows 95 applications will probably store recent-file information in the Registry rather than in an .INI file. If the application doesn't offer a command to clear the list, you can edit the Registry. Here's how you would clear the recent-files list for the WordPad accessory. Start the REGEDIT utility using the Start menu's Run command, then click on the plus sign next to HKEY_CURRENT_USER to open that node. Click on the Software node and search for WordPad. Click the plus sign to open the WordPad node, then select the key named Recent File List (Figure 1). In REGEDIT's right-hand panel, you'll see one or more values named File1, File2, and so on; delete them.

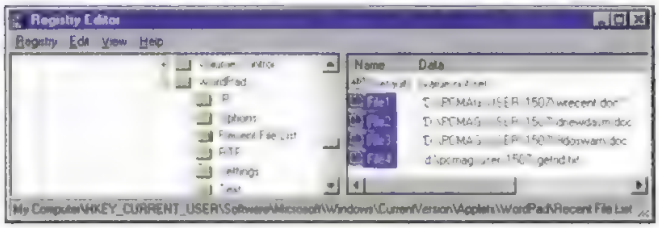

FIGURE 1: *Clearing the recent-files list in some Windows 95 applications can involve editing the Registry.*

The Registry is essential to the operation of Windows 95, so use REGEDIT with extreme care. If you'd rather not chance messing anything up, you can clear the recent-files list by brute force. Simply create as many dummy files as necessary to push your secret files off the list, then delete the dummy files.

Under Windows 95, the system itself maintains a list of recently used documents, so your cleanup isn't finished yet. The Documents choice on the Start menu brings up a menu of recently used documents of various types. To clear this menu, select Settings | TaskBar...

HIGHLIGHTS

HARDWARE Here's the scoop on hard disk and L2 caches. They perform similar but separate tasks—and you should know the difference. *Page 286*

OPERATING ENVIRONMENTS If you want to delete .TMP files from your hard disk, do it without jeopardizing Windows performance. *Page 290*

DATABASES Use any of the printable ASCII characters when you're incrementing a numeric value stored as a character string and you'll be able to generate many more unique values. *Page 304*

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See index, page 286.

from the Start menu. Click the Start Menu Programs tab in the resulting dialog and press the Clear button. Now nobody can see what you've been working on.

Easy .COM File Disassembly

The last time you presented a method of disassembling a .COM file was five years ago (January 31, 1989, with a correction in the issue of May 16, 1989). That method is somewhat dated now, since it required EDLIN, which is no longer shipped with DOS. I've created a technique that uses just one batch file, DISASM.BAT (Figure 2), and a DEBUG script, GETSIZE.SCR (Figure 3), that you use only once to create the 55-byte file GETSIZE.COM.

Creating DEBUG scripts using the batch file also seems to be faster than using EDLIN to create them.

PERRY EDLER,
Sedro Woolley, Washington

PC MAGAZINE: Though they're increasingly less common, .COM files still exist, and Windows 95 does still include the DEBUG utility, which can disassemble all or part of any .COM file. The U (for Unassemble) instruction takes a starting address and a length or ending address and unassembles all instructions in that range. The one hitch in automating this process with a DEBUG script is that you need to know the size of the .COM file, expressed in hexadecimal.

DEBUG itself initializes the BX and CX registers with the 32-bit size of the loaded file, the upper 16 bits in BX, the lower 16 bits in CX. Since .COM files are restricted to 64K, the CX register holds the size of a .COM file loaded into DEBUG. The DEBUG script DBG1.SCR, created and executed by DISASM.BAT, causes DEBUG to read the value of CX and then quit.

```
@if not exist %1.COM goto notfound
@echo RCX   >DBG1.SCR
@echo 0    >>DBG1.SCR
@echo Q    >>DBG1.SCR
@debug %1.COM | GETSIZE <DBG1.SCR.>
DBG2.SCR
@echo File %1.LST is being created
@debug %1.COM <DBG2.SCR  | find ":" >
%1.LST
@del DBG?.SCR
@goto end
:notfound
@echo File '%1.com' Not Found
@echo Enter File Name (without .com
@echo extension)
:end
```

FIGURE 2: *This batch file disassembles any .COM file, with the help of a tiny utility created using the DEBUG script in Figure 3.*

```
A 100
MOV   AH,3F      ; read file handle 0
MOV   BX,0000    ; which is STDIN
MOV   CX,0020    ; read 32 bytes
MOV   DX,0137    ; pointer to buffer
INT     21       ; to read into
MOV   SI,0144    ; pointer to source
MOV   DI,012E    ; pointer to destn
CLD              ; auto increment
MOVSW            ; move first 2 bytes
MOVSW            ; move last  2 bytes
MOV   AH,40      ; write file handle 1
MOV   BX,0001    ; which is STDOUT
MOV   CX,000F    ; write 15 bytes
MOV   DX,0128    ; pointer to buffer
INT     21       ; to write from
MOV   AX,4C00    ; exit
INT     21

ECS:128 'U100 Lxxxx'
ECS:132 0d 0a 'Q' 0d 0a

RCX
37
N GETSIZE.COM
W
Q
```

FIGURE 3: *The .COM file created by assembling this script with DEBUG lets the batch file in Figure 2 disassemble any .COM file.*

Its output looks something like this:

```
-RCX
CX 0037
:0
-Q
```

where 0037 is the file size in hexadecimal. This output is piped through GETSIZE.COM, which builds DBG2.SCR using the file size. DBG2.SCR for the same file would look like this:

```
U100 L0037
Q
```

DISASM.BAT now calls DEBUG to process the .COM file again. The new script unassembles the file from its origin at address 0100 for its entire length, redirecting the output to a file with the same name as the .COM file and the extension .LST. A little cleanup and the process is done.

To create GETSIZE.COM from GETSIZE.SCR, use this command:

```
DEBUG < GETSIZE.SCR > GETSIZE.LOG
```

Search the GETSIZE.LOG file for the string "^Error"; if present, fix the error and try again. Delete GETSIZE.LOG after you've successfully processed GETSIZE.SCR.

Batch File Vagaries Under DOS 7

With the advent of Windows 95, DOS isn't dead—but it is different. When you select MS-DOS Prompt from the Windows 95 Start menu, you're opening a DOS box, just as in Windows 3.1. And when you restart Windows 95 in MS-DOS mode, familiar DOS is what you see; Windows 95 isn't visible at all. But not only does DOS 7—the Windows 95 version—differ from previous DOS versions in a number of ways, there are behavioral differences between DOS in a DOS box and DOS after rebooting in MS-DOS mode.

As noted in a recent User-to-User item (February 20, 1996), in MS-DOS mode the XCOPY command's parameters are equivalent to those found in DOS 6.0. In a DOS box, however, XCOPY adds nearly a dozen new parameters. Type XCOPY /? at the command line to see all the switches.

For serious batch file programmers, one of the most problematic changes is the removal of an important quirk from the FOR command. Since time immemorial, the FOR command has provided special treatment for the slash character. Prefixing an item in the FOR command's list with a slash caused FOR to treat it as two items, the first character and the remainder. For example, at the DOS prompt the following command would echo two lines, "B" and "ruin":

```
FOR %v IN (/Bruin) DO ECHO "%v"
```

Batch file authors have used this feature to program substantial string-processing functions. They have parsed strings, rearranged dates into YYMMDD order for sorting, even extracted the directory, filename, and extension portions of a fully qualified filename. Once you can split a string into its individual characters, many things are possible.

In DOS 7, unfortunately, the FOR command's behavior with respect to the slash character changes. It no longer splits off the first character of the following string, but instead appears to capitalize the string. Thus, the example above will echo "/BRUIN" under DOS 7. And any batch file that relied on this feature of the FOR command will now fail.

In general, you can't be sure an existing batch file, especially a complex one, will work correctly in DOS 7 or that it will work the same way in a DOS box and in MS-DOS mode. That includes batch files previously published in the User-to-User column. You'll need to test each batch file carefully before accepting it as functional in DOS 7. If you discover other differences between DOS 7 and earlier versions, especially differences that break existing batch files, please take a moment and submit them to this column.

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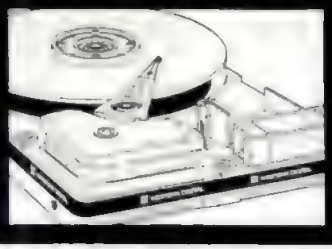

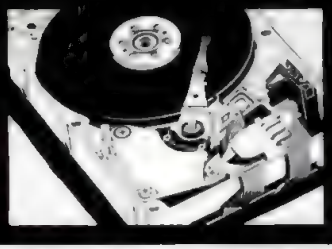

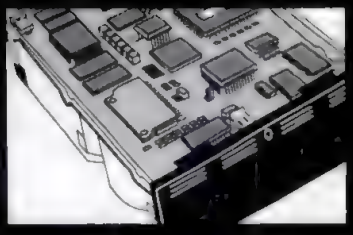

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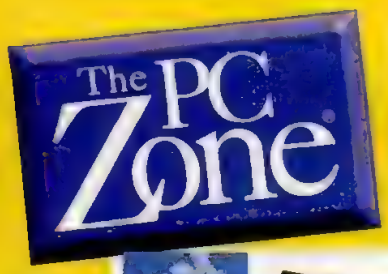

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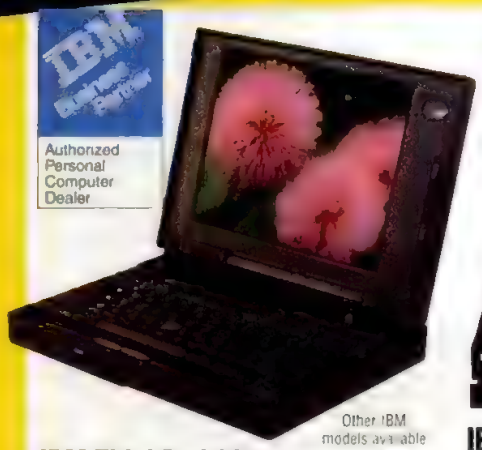

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120MHz	1.2GB	10.4" Active	#30651	$4439
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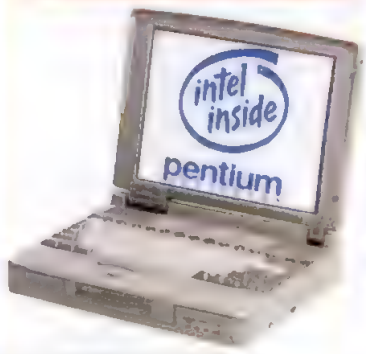

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Does 3 Equal 9?

What's the difference between a 9-chip, 30-pin SIMM and a 3-chip, 30-pin SIMM? Is there any reason not to buy the 3-chip variety, since it's cheaper? Can you mix 3- and 9-chip SIMMs?

SCOTT D. MAGEE, *via ZD Net*

PC MAGAZINE: From a logic point of view, there's no difference between a 3-chip and a 9-chip SIMM. There are some electrical and cost differences, however, which can affect your purchase decision.

The 9-chip units use a separate memory chip for each bit. A 1MB 9-chip SIMM would include nine 1Mb (megabit) chips: eight for the data bits and one more for the parity bit. A 3-chip unit combines a pair of 4-bit chips with a single 1-bit chip; the two 4-bit chips supply the eight data bits, and the single chip provides the parity bit. (There are also 8-chip and 2-chip SIMM configurations without parity support for those computers that don't require the parity bit.)

The 3-chip units cost less, simply because the chip count is lower. Unfortunately, not all motherboards can work with 3-chip SIMMs because of subtle differences in the refresh timing requirements. To be safe, check with your motherboard maker or just spend the extra few bucks for the 9-chip models.
—*Alfred Poor*

Life in the Slow Lane

I recently upgraded to Windows 95 on a system that has a SCSI-2 hard disk, a SCSI CD-ROM drive, and a sound card. When I bring up Control Panel and check System Properties Performance (double-click on the System icon and select Performance), it says that the ASPI3X92 line in my CONFIG.SYS file is forcing MS-DOS compatibility mode, which reduces overall system performance. Is there a way to fix this?

W. WELCH, *Anchorage, Alaska*

PC MAGAZINE: The problem is that the driver in your CONFIG.SYS file is a real-mode (16-bit) driver, which prevents Windows 95 from running in protected mode with a 32-bit driver. The fix may be as simple as putting a "REM" at the start of that line and rebooting. (Always remark out unwanted lines instead of deleting them; you may need them in the future. Either way, you should always make backup copies of CONFIG.SYS and AUTOEXEC.BAT before you make any changes at all.)

Windows 95 has its own 32-bit protected-mode drivers for myriad devices. The Add New Hardware wizard (accessible via the Control Panel) can search through your system and identify all your hardware components. Although your CD-ROM drive probably works with Windows 95's drivers, Windows 95 failed to remark out the CONFIG.SYS line that loaded your real-mode ASPI driver. (ASPI, or advanced SCSI programming interface, provides a driver for many SCSI devices other than hard disks.) If you remark out this line yourself, Windows should be able to use its own protected-mode ASPI driver and forsake MS-DOS compatibility mode. You should also be able to remark out any other CD-ROM driver and Microsoft CD-ROM extension (MSCDEX) lines in your CONFIG.SYS and AUTOEXEC.BAT files.

If your system does not work without the ASPI driver, find out where your CD-ROM drive is connected. If it's connected to your

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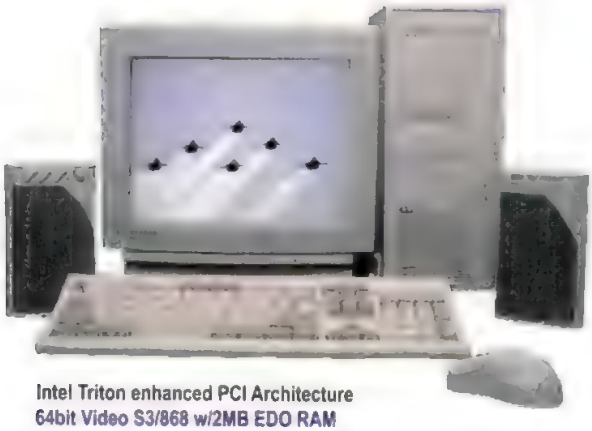

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CIRCLE 165 ON READER SERVICE CARD

sound card, Windows 95's driver may not work with your SCSI connection. You can eliminate the problem by attaching the CD-ROM drive to the same controller as your hard disk. Just make sure you have unique SCSI IDs assigned and the termination set correctly.

Each SCSI device on a SCSI chain must have a unique ID. Since a SCSI chain may have up to eight devices—including the controller card—the ID numbers range from 0 to 7. Different devices have their IDs set in different ways: Some use a set of jumpers or DIP (dual in-line package) switches, while others use rotary switches. You should consult the documentation for your SCSI devices to see how the ID is set for each one.

SCSI chains also require that the chain be terminated (with a resistor pack) at each end of the chain, but nowhere else. Some devices are able to sense automatically whether they are at the end of a chain and adjust their termination settings accordingly. Others may have a jumper or DIP switch that can enable or disable termination. Still other devices may require physical terminators, either an external plug that attaches to a cable connector or a series of SIP (single in-line package) resistors that must be inserted or removed. Again, consult the documentation for each SCSI device to determine which form of termination your devices use.—*Alfred Poor*

Cache Confusion

While researching hard disks, I found drives available with and without caches. I don't understand: Isn't the external L2 cache sufficient? Does it make sense to buy a hard disk with a cache if you already have an L2 cache? And how do things work if you have two caches? Are the two caches seen as one memory area regardless of combined cache size?

J. L. SUNDSTROM, *via the Internet*

PC MAGAZINE: Your confusion is understandable, but the explanation is pretty simple. The cache on a hard disk has nothing to do with the L2 cache. A hard disk cache consists of memory built into the hard disk's electronics. It usually results in better performance: Access to the hard disk data is quicker, because some of the hard disk's data is held in memory right on the drive. This makes it possible to spool the data to the hard disk controller at the same time that the drive heads are moving to the next location on the drive where data is needed.

The L2 cache, on the other hand, exists as a buffer between the system memory and the CPU. It holds recently accessed data, so the next piece of information the CPU requires will likely be there when needed. The CPU can access the faster SRAM (static RAM) used for the L2 cache memory in less time than it can access the slower DRAM (dynamic RAM) used for the system memory.

The cache on the hard disk works between the hard disk and its controller, while the L2 cache acts between the CPU and the system memory. Thus, they perform similar but separate tasks.—*Alfred Poor*

OPERATING ENVIRONMENTS

Deleting Temporary Files

*Whenever Windows crashes, one result is the temporary files left scattered all over my hard disk. But I've added a line to the end of my AUTOEXEC.BAT file that eases the chore of cleaning up the disk: DIR *.TMP /S. Now every time I boot up, I get a list of every .TMP file on my hard disk, and I can then delete them.*

The first time I used this command, there were so many .TMP files in so many directories that I tried to find a global delete command to delete all .TMP files automatically. I never did find one, but with Windows' File Manager I was able to search for and delete them more easily.

I crash Windows fairly often and have noticed that the .TMP files tend to end up in the directory of the program I was using, such as Microsoft FoxPro for Windows. This surprised me, since my AUTOEXEC.BAT file includes the line SET TEMP=C:\TEMP. I would have expected this to be the most likely place to find the stray files.

JEFF WYATT, *Abilene, Texas*

PC MAGAZINE: File Manager's Search function does indeed make it easy to locate and operate on files matching a particular template, wherever they may reside on your disk. But you're making a big mistake by deleting .TMP files that way! While Windows is running, .TMP files are sacrosanct; deleting them can cause the Windows crashes that you say occur "fairly often." The only safe way to clean up orphaned .TMP files is to do it completely outside of Windows.

Here's one technique you can use to locate and delete all .TMP files. In the root directory of the C: drive, issue the command

```
DIR *.TMP /A /B /S > DELTEMPS.BAT
```

You will get a listing of the complete pathname of every .TMP file, even those with attributes that would normally hide them from view. Load the DELTEMPS.BAT file into DOS's EDIT program and select Change from the Search menu. Search for C:\ and replace it with DELTREE /Y C:\. Save the file, exit EDIT, and run DELTEMPS.BAT. This will wipe every .TMP file from your disk. The reason to use DELTREE instead of just DEL is that it will delete even files with read-only, hidden, or system attributes.

As for why the .TMP files are scattered instead of residing in the directory identified by your TEMP environment variable, that's because individual applications are free to create temporary files anywhere they want. There's nothing that forces them to use the official TEMP directory.—*Neil J. Rubenking*

Automate Access to PKUNZIP in Windows 95

In Windows 3.1, I was able to automate unzipping of files by adding the line

```
ZIP=C:\UTIL\PKUNZIP.EXE ^.ZIP
```

to the [Extensions] section of my WIN.INI file. But this doesn't work with Windows 95. Is there any way I can automate unzipping in Windows 95?

J. I. MASON, *Yucca Valley, California.*

PC MAGAZINE: As is often the case, an .INI file–based technique in Windows 3.1 becomes a Registry-based technique in Windows 95. To associate the .ZIP extension with PKUNZIP requires a moderately complex entry in the Registry. Windows 95 comes with a Registry editor program named REGEDIT, but for adding keys it's safer to use a .REG file like the one shown in Figure 1. Edit this file so the PKUNZIP directory matches the one on your system, then save the file. Note that you must use double backslashes (\\) between the directories in the full path. Now launch the .REG file by double-clicking on it or by using the START command at a command prompt. The new keys will be automatically added to the Registry. From now on, when you double-click a .ZIP file, it will be unzipped automatically.

```
REGEDIT4

[HKEY_CLASSES_ROOT\ArchiveFile\Shell\Open\Command]
@="\"D:\\UTILNBAT\\PKUNZIP\" \"%1\""

[HKEY_CLASSES_ROOT\.zip]
@="ArchiveFile"
```

FIGURE 1: *Launch this file in Windows 95 to associate .ZIP files with PKUNZIP. Don't forget to edit it first to reference the actual location of PKUNZIP on your system.*

Do note that two recent *PC Magazine* utilities automate the use of .ZIP files in a more modern fashion. When ZipView (December

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Satellite Pro 400	Pentium 75	10.4" Dual Scan	8MB/772MB	MAT4ØØCS7	2,599
Satellite Pro 410	Pentium 90	11.3" Dual Scan	8MB/772MB	TA41ØCS7	3,419
Satellite Pro 410	Pentium 90	11.3" Active	8MB/772MB	TA41ØCDT7*	4,199
Portege 610CT	Pentium 90	9.5" Active	8MB/686MB	TA61ØCT6	3,899
Tecra 700	Pentium 120	11.3" Dual Scan	8MB/1.13GB	TA7ØØCS	4,599
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TravelMate 5100	90MHz Pentium®	10.4" Active Matrix VGA	8MB/1.2GB	TEXTP9ØCT	3,399
TravelMate 5100	90MHz Pentium®	10.4" Active Matrix SVGA	8MB/1.2GB	TEXTP9ØCTC	4,099
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DX15T	15"	1280 x 1024	NI	.25mm	CMDX15T	449
DX1795	17"	1280 x 1024	NI	.26mm	CMDX1795	699
DX17T	17"	1280 x 1024	NI	.25mm	CMDX17T	789
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28.8 Voice View VI	INT	28.8/14.4	MBUSRVI28I	195
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1282MB	10.5ms	3.5" .75"H	IDE Fast-ATA-2	128	5,400	ST5127ØA	239	289
2113MB	10.5ms	3.5" 1"H	IDE Fast-ATA-2	128	5,400	ST3214ØA	349	399
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2149MB	9ms	3.5" 1"H	Fast-SCSI-2 A/V	512	5,411	ST32151N	649	749
4294MB	9ms	3.5" HH	Fast-SCSI-2 A/V	512	5,411	ST1523ØN	999	1,099
9090MB	11ms	5.25" FH	Fast-SCSI-2 A/V	1,024	5,400	ST41Ø8ØØN	2,175	2,275
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4294MB	8ms	3.5" HH	Fast Wide SCSI-2 A/V	1,024	7,200	ST1515ØW	1,249	1,399
9090MB	11ms	5.25" FH	Fast Wide SCSI-2 A/V	1,024	5,400	ST41Ø8ØØW	2,185	2,335

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4200MB	8.9ms	3.5" HH	Fast SCSI-2 A/V	512	7,200	FJ2934S	959	1,059
Fujitsu 68 Pin Wide SCSI Drives								
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4200MB	8.9ms	3.5" HH	Fast Wide SCSI-2 A/V	512	7,200	FJ2934W	959	1,059
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4300MB	8.5ms	3.5" HH	Fast-SCSI-2	512	7,200	MC3243S	1,029	1,129
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4300MB	8.5ms	3.5" HH	Fast-SCSI-2 A/V	512	7,200	MC3243AV	1,139	1,239
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1280MB	11ms	3.5" 1"H	Fast-SCSI-2	128	5,400	QUFB128ØS	329	429
2150MB	8ms	3.5" 1"H	Fast-SCSI-2	1,024	7,200	QUXP3125S	799	899
4300MB	8ms	3.5" HH	Fast-SCSI-2	1,024	7,200	QUXP343ØS	1,099	1,199
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4500MB	8ms	3.5" HH	Fast-SCSI-2	512	7,200	IB94G3196	1,599	1,699
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IBM SCSI 68 Pin Wide Drives								
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4500MB	8ms	3.5" HH	Fast Wide SCSI-2	512	7,200	IB94G3Ø57	1,699	1,849
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1080MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD21ØØØA	219	269
1280MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD212ØØA	229	279
1620MB	9ms	3.5" 1"H	Enhanced IDE	128	5,200	WD316ØØA	279	329
2113MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD321ØØA	379	429
2559MB	10ms	3.5" 1"H	Enhanced IDE	128	5,200	WD325ØØA	429	479

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VESA IDE controller, 32-bit, single channel extender card GSIMODELV1 69
VESA IDE controller 32-bit GSIMODELV2 119

Capacity**	Access	Form/Height	Interface	Cache	RPM	Model	Bare Kit	16 Bit Kit*
Toshiba 2.5" IDE Drives								
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1300MB	13ms	2.5" 12.7mm	IDE	128	4,200	MK13Ø1MAV	699	N/A
1300MB	13ms	2.5" 19mm	IDE	128	4,200	MK272ØFC	599	N/A
2100MB	13ms	2.5" 19mm	IDE	128	4,200	MK21Ø1MAN	***NEW!! Call for pricing!!***	
Fujitsu IDE Drives								
1090MB	12ms	3.5" 1"H	Fast-ATA-2	64	4,500	FJ614A	215	265
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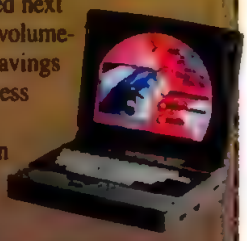

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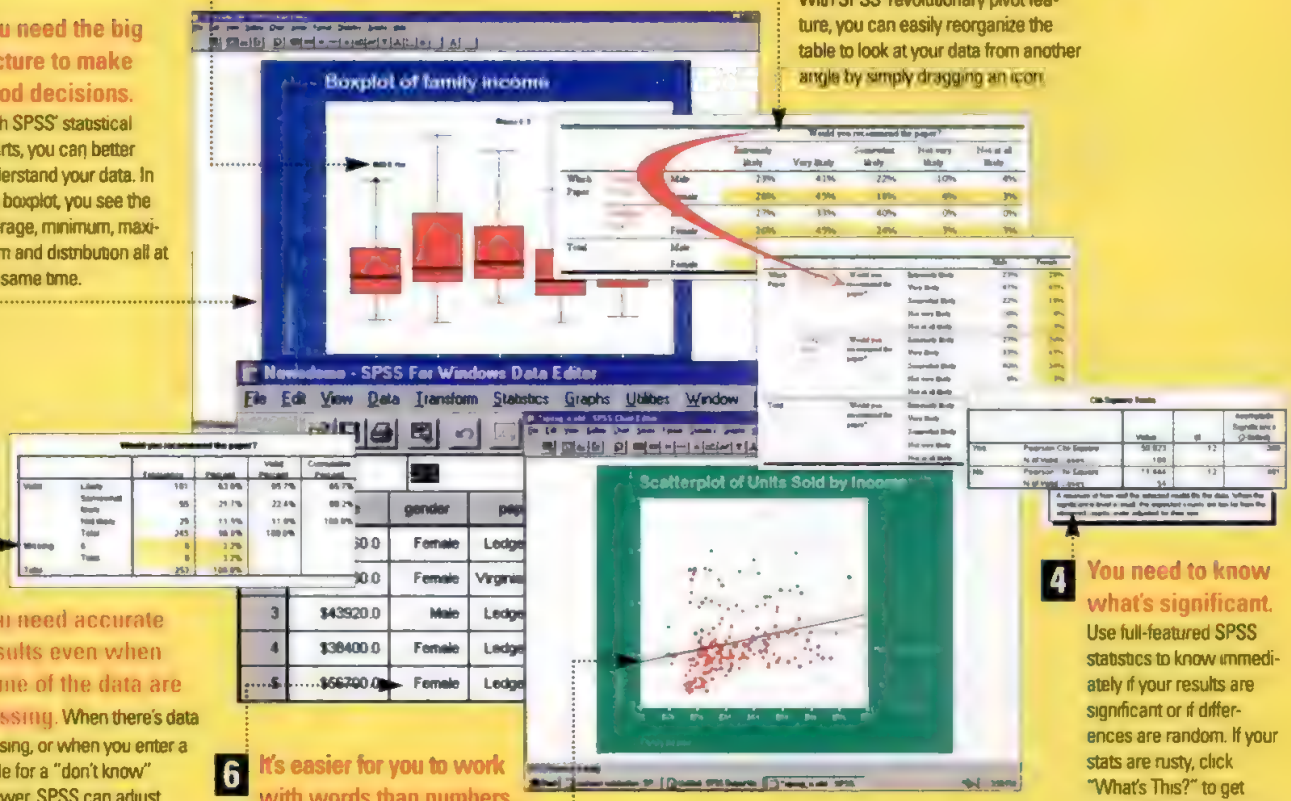

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19, 1995) is installed, the properties sheet for .ZIP files has a Contents page that lists the .ZIP file's contents and allows you to extract them. When ZipDrop (January 23, 1996) is installed, .ZIP files gain the ability to accept files via drag-and-drop—the dropped files are automatically moved into the .ZIP archive. —*Neil J. Rubenking*

WORD PROCESSING

Saving and Closing Multiple Documents in WP for DOS 6.0

In the September 12, 1995, issue of PC Magazine, *you presented the macro SAVEALL2.WPM for saving multiple open documents in WordPerfect for DOS 6.0. The macro is very helpful, but it would be even more so if it closed files in addition to saving them. WordPerfect's HOME/F7 command almost serves that purpose by letting you save all open files, close them, and exit WordPerfect, but normally I want to stay in WordPerfect after closing files. Can you modify the macro so it will both save and close files?*

ANN HOWARD, *Andover, New Jersey*

PC MAGAZINE: The option to save and close multiple files is a useful-enough wrinkle to earn a second visit to this subject. Figure 2 shows a macro, SAVNCLOS.WPM, that will do the job. The SAVNCLOS macro is shorter than the original SAVEALL2.WPM macro—mostly because it doesn't have to keep track of the document from which you started the macro in order to return you to that document when it's done.

The key to SAVNCLOS is a FORNEXT . . . ENDFOR loop that steps through each document—from 1 to 9—one document at a time. For each step through the loop, the macro first switches to the appropriate document using the SwitchDoc command, then uses an IF statement to test whether or not the document has been modified since the last save. If the document has been modified, the macro saves it. Then, whether or not the document has been modified, the macro closes the document. After stepping through all nine possible documents, the macro leaves you in a new, empty document 1.

```
DISPLAY(Off!)
CANCEL(OFF!)
FORNEXT(Docnum: 1: 9: 1)
     SwitchDoc(Docnum)
     IF (?DocModified)
          Save
     ENDIF
     Close
ENDFOR
```

FIGURE 2: *The SAVNCLOS macro for WordPerfect for DOS 6.0 lets you save and close multiple open files with a single command.*

```
DISPLAY(Off!)
CANCEL(OFF!)
MenuList(choice:{"~Save all and
continue":"~Close all after
saving"};)
Switch(Choice)
     CASEOF 1:
          Closeall="No"
     CASEOF 2:
          Closeall="Yes"
          GO(DoIt)
ENDSWITCH
ASSIGN(StartDoc: ?DocNumber)
LABEL(DoIt)
FORNEXT(Docnum: 1: 9: 1)
     SwitchDoc(Docnum)
     IF (?DocBlank)
          Close
     ELSE
       IF (?DocModified)
            Save
       ENDIF
       IF (Closeall="Yes")
            Close
       ENDIF
     ENDIF
ENDFOR
IF (Closeall="No")
     SwitchDoc(StartDoc)
ENDIF
```

FIGURE 3: *The SAVNCLO2 macro for WordPerfect for DOS 6.0 lets you save multiple open files with the choice of either closing them afterward or continuing to work on them.*

Since you ought to be saving your documents on a regular basis as you work with them as well as when you're finished, you can treat the SAVNCLOS macro as a companion to the original SAVEALL2 macro, rather than as a replacement for it. Simply use SAVEALL2 when you want to save and continue working, and use SAVNCLOS when you're finished. You may, however, prefer the SAVNCLO2 macro in Figure 3, which combines both functions in a single macro. (You'll find both SAVNCLOS and SAVNCLO2 in the file SAVNCLO.ZIP on PC Magazine Online.)

The SAVNCLO2 macro takes advantage of the MenuList command to let you choose between saving and continuing to edit on the one hand, or saving and closing all documents on the other. If you run the macro, the two choices, "Save all and continue" and "Close all after saving," show up as menu items. Notice the tildes before the S in Save and the C in Close. These specify the characters you can type to choose one command or the other.

The CASEOF statements between the SWITCH . . . ENDSWITCH statements tell the macro what to do depending on whether you pick the first or second menu item. If you pick the first item, "Save all and continue," the macro sets the variable Closeall to No, then picks up after the ENDSWITCH statement with the ASSIGN command, which sets the variable StartDoc to the current document number. If you plan to continue editing, the macro will need this information later to leave you in the same document from which you started the macro. If you pick the second item, "Close all after saving," the macro sets the Closeall variable to Yes and then goes to the label DoIt, skipping over the ASSIGN statement.

Next comes the FORNEXT . . . ENDFOR loop that, once again, is the heart of the macro. Here, the macro steps through each document, one at a time, from 1 to 9. And again, for each step through the loop, the macro starts by switching to the next document with the SwitchDoc command. It then tests to see whether the document is blank, using the ?DocBlank system variable.

If the document is blank, the macro closes it. If the document isn't blank, the macro next tests to see if it has been modified, using the ?DocModified system variable. If it has been modified, the macro saves it. Next, if the variable Closeall equals yes—meaning you chose the "Close all after saving" option in the menu—the macro closes the document.

Finally, after finishing the FORNEXT . . . ENDFOR loop, the macro uses the IF . . . ENDIF statement to test the value of Closeall. If Closeall is set to Yes (you told the macro to close all documents), the macro simply finishes. If Closeall is set to No (you chose to save the documents without closing them), the macro uses the SwitchDoc command to switch back to the document you were in when you started the macro.
—*M. David Stone*

SPREADSHEETS

Moving the Cellpointer in Excel

I recently discovered that if you use Excel's Move Selection After Enter feature, you can still enter a value or formula in a cell and have the cellpointer stay in the current cell. If you press Enter with Move Selection After Enter on, the cellpointer moves down one row. If you press Ctrl-Enter, however, the cellpointer stays in the current cell. I also discovered that by pressing Shift-Enter, you can make the cellpointer move up instead of down.

CHUCK PASEK, *Parsons, Kansas*

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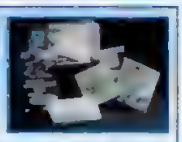

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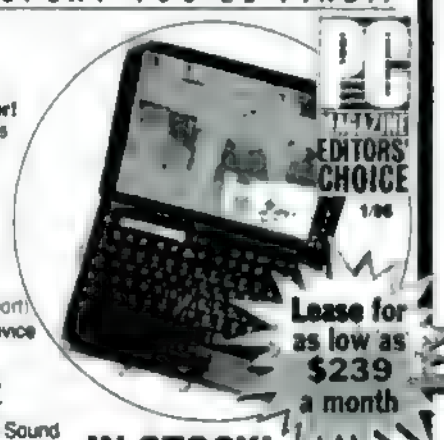

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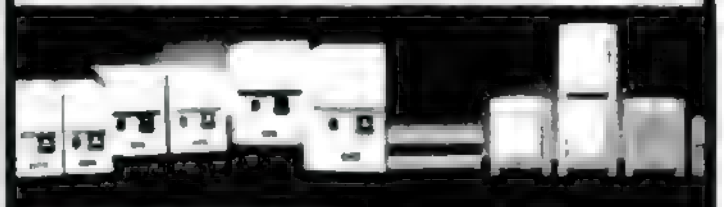

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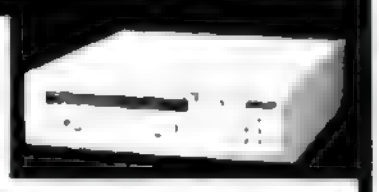

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CIRCLE 010 ON READER SERVICE CARD

PC MAGAZINE: All recent versions of Excel employ the Ctrl-Enter keystroke combination as a means for users to enter a value or formula into many cells at once. Select a range, type a formula or value, and terminate the entry with Ctrl-Enter, and Excel puts your entry in each selected cell, updating relative references appropriately. But as Mr. Pasek points out, Ctrl-Enter plays an additional role in the current version, allowing you to keep the cellpointer in the current cell if the Move Selection After Enter toggle is on.

Unfortunately, Ctrl-Enter overrides the Move Selection After Enter setting only when that setting is on. If you leave it off, Ctrl-Enter will not make your cellpointer move down a row. And, because of Ctrl-Enter's original function—multiple-cell entry—you can't use it to keep the cellpointer from moving when your selection encompasses multiple cells.

If you find yourself resetting the Move Selection After Enter toggle often, you might want to create a simple toggle macro such as the following:

```
Sub ToggleMSAE()
 'Toggles the Move Selection After
 'Enter option
 Application.MoveAfterReturn =
➥Not(ApplicationMoveAfterReturn)
End Sub
```

To make the macro readily available, store it in a workbook named PERSONAL.XLS and store the workbook in your XLSTART directory. Then assign the macro to a toolbar button or to a command on your Tools menu.

You should also be aware that you can adjust the Move Selection After Enter toggle to move the cellpointer in any of the four directions, not just down. A drop-down list in the Tools | Options | Edit dialog box lets you specify which way you want the selection to move. And, as Mr. Pasek discovered, holding down the Shift key while pressing Enter causes the cellpointer to move in the direction opposite to your setting—up if your setting is down, left if the setting is right, and so on. To control the cellpointer's heading with a macro, set the property Application.MoveAfterReturnDirection to xlUp, xlDown, xlToLeft, or xlToRight.—*Craig Stinson*

DATABASES

Incrementing IDs—Revisited

The Solutions column of November 7, 1995, presented a FoxPro function to increment a numeric value stored as a character string. But if you're storing a unique value in a character string, why use only numbers? A 5-character string, in that case, yields only 99,999 unique numbers, but if you include the whole range of printable characters from ASCII 33 to ASCII 126, you can generate 94^5 (7,339,040,224) unique values.

That's enough unique values to generate a new one every second for over 200 years! And since they're all printable characters, you don't have to worry about side effects from viewing the contents in FoxPro's BROWSE windows. Figure 4 shows a function to increment IDs to the next unique value using printable ASCII characters.

MIKE ROTHAUS,
Conshohocken, Pennsylvania

```
*************************************************************
* FUNCTION Idincr( cId )
* Increment a character string to the next unique ID using
* the printable characters from chr(33) - chr(126).
* Syntax:  cNewId = Idincr( cId )
*************************************************************
FUNCTION Idincr
PARAMETER cId

#DEFINE LoChar 33
#DEFINE HiChar 126
#DEFINE Errchar 27

PRIVATE ReturnID, Cpos, CurDigit

m.nIdlen = LEN(m.cID)   && Save the length of the id
IF EMPTY(m.cID)
  * Return the beginning ID (just like starting at 1).
  m.ReturnID = REPLICATE( CHR(LoChar), m.nIdlen )
ELSE
  * Start at the beginning, incrementing the first character.
  * If the first character is equal to HiChar, reset it to
  * LoChar and continue to the second character.  Continue
  * in this fashion until a character is not equal to HiChar (or
  * in the most unusual circumstance, every character in cID is
  * equal to HiChar and is to be replaced with LoChar, essentially
  * exhausting the pool of IDs, in which case we return a string
  * of Errchars.)
  m.ReturnID = m.cID
  m.Cpos = 1
  DO WHILE .T.
    m.CurDigit = ASC( SUBSTR(m.ReturnID,m.Cpos,1) )
    IF m.CurDigit < HiChar
      m.ReturnID = STUFF( m.ReturnID, m.Cpos, 1, CHR(m.CurDigit+1) )
      EXIT
    ELSE
      m.ReturnID = STUFF( m.ReturnID, m.Cpos, 1, CHR(LoChar) )
      m.Cpos = m.Cpos + 1
      IF m.Cpos > m.nIDlen
         m.ReturnID = REPLICATE( CHR(Errchar), m.nIDlen )
         EXIT
      ENDIF
    ENDIF
  ENDDO
ENDIF
RETURN m.ReturnID

#UNDEF LoChar
#UNDEF HiChar
#UNDEF Errchar
```

FIGURE 4: *Use this function to increment a character ID to the next value using any of the printable ASCII characters.*

PC MAGAZINE: This is an interesting approach to generating unique IDs. The resulting values are not necessarily pleasing to look at, because they include characters like !, $, and ~, for instance, but they are unique and you can

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CIRCLE 274 ON READER SERVICE CARD

generate a lot of values in a lot less space than you'd need for strictly numeric characters. The values so generated can serve a useful purpose as primary key values in a FoxPro table, especially since FoxPro lacks any type of AutoIncrement counter type (even the newer and more capable Visual FoxPro lacks the AutoIncrement type).

You might be wondering why you'd place values that read like gibberish in your table as primary keys, but in truth the only requirement for a primary key is that it uniquely identify a row. It doesn't have to—and probably shouldn't—have any real meaning or "describe" the row. That's because it would then be more likely to be subject to change, and primary key values should never change. All the primary key needs to do is uniquely identify a row so that its primary key value can be placed in related rows in other tables.

I modified Mr. Rothaus's routine so that it returns a string of error characters when the pool of available IDs becomes exhausted. You can download the function (Idincr.prg) from PC Magazine Online.—*Sal Ricciardi*

GRAPHICS

Color-Matching Blues

Some time ago I purchased a new color printer, a Fargo Primera Pro, based on PC Magazine's *recommendation. Soon afterward I added a UMAX Vista-S6 scanner (bundled with Adobe Photoshop 3.0) to my system. When I scan pictures into Photoshop using the Twain interface, the resulting screen image on my Sony Multiscan 17se monitor is very close to the original photo. But when I print the image, some colors match almost perfectly and others are so far off the color chart I could scream!*

I've already wasted a lot of money on bad thermal wax printouts, trying to get a good color match. It doesn't seem to matter whether I use RGB or CMYK for printing. Fargo's tech support department can't seem to help me. And the Fargo printer is not available as a choice in Photoshop's Printing Inks Setup dialog box. There must be some way out there to get accurate printing colors from Photoshop.

CRAIG CARMER,
Sellersville, Pennsylvania

PC MAGAZINE: There are two immediate solutions to your problem. The first—and easiest—approach is simply to buy Agfa's FotoTune 2.01. This color-management system, available as a plug-in for Adobe Photoshop for Windows, contains a dedicated color-matching engine that acts as a translator between the RGB color space of a scanner (or monitor) and the CMYK colorspace of a printer. In order to work properly, FotoTune (or any color-management product) must have an accurate description—called a device profile—of the scanner's, monitor's, and printer's color gamut.

The Light version of FotoTune (FotoTune LE) costs only $395 and contains predefined profiles of popular scanners, monitors, and printers—including the Fargo dye-sublimation printer. For more control over the color-matching process, however, you should consider buying the full FotoTune package ($795), which gives you the ability to create custom device profiles. To do this, you scan a supplied test image (the industry-standard IT8 color target), print it out using your specific printer, and then rescan the printout. FotoTune compares the color values from your printout with control color values stored internally and creates a calibration curve based on the differences. For more information, contact Agfa directly at 800-685-4271.

A less expensive solution requires you to create a custom device profile within Photoshop's Printing Inks Setup dialog box (shown in Figure 5). Instead of duplicating the step-by-step instructions from Photoshop's manual, I'll explain what each of these functions accomplishes.

When you choose a device from the Ink Colors drop-down list, you are plugging in a predefined set of cyan, magenta, yellow, and black ink values. Instead of choosing these predefined values, choose the Custom option and Photoshop will present you with another dialog box where you can enter new values for the color dyes in your dye-sublimation printer. If you have access to a spectrophotometer, you can enter Yxy values. Don't be intimidated by this high-end feature. Simply clicking on each of the color swatches brings up the standard Photoshop color picker where you can match colors visually. It isn't technically accurate, but I've found you can dramatically improve color-matching just by eyeballing.

The Dot Gain setting allows you to compensate for the increased saturation of most printing methods. For example, a printer that exhibits a 20-percent dot gain will produce a 60-percent tint of color when only a 50-percent tint exists in the electronic file (think back to elementary-school mathematics: 20 percent of 50 is an additional 10 percent). Photoshop uses the value you enter here to reduce the amount of ink or dye laid down on the paper. For example, if you enter a dot-gain value of 20 percent, Photoshop substitutes a value of 42 percent for the original 50-percent tint. When the 42-percent tint prints with a 20-percent dot gain, the final result is 50 percent—resulting in a better color match.

The Gray Balance values allow you to correct for color casts introduced by a printer. For example, digital printers typically suffer from a cyan color cast. The values you enter here are basically gamma values that can lighten or darken the midtones for a specific ink or dye color. Once again, Photoshop provides an empirical way for you to determine the correct gamma values for your particular printer by converting an RGB picture to CMYK and then using the Levels dialog box to adjust the gamma until the screen image matches the printout. Pay special attention to the Gray Balance function—the fact that some colors print correctly while others print incorrectly points toward a color-cast problem.

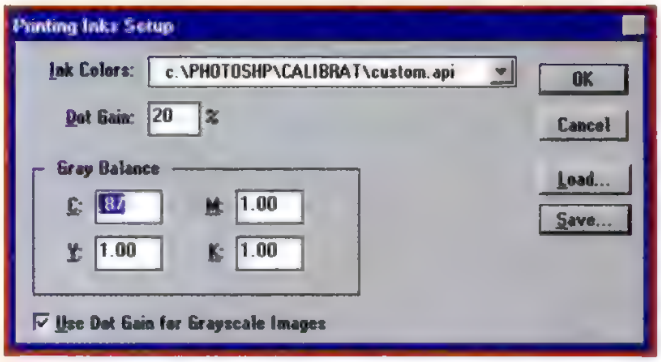

FIGURE 5: *You can get better color matches by creating a custom device profile within Photoshop's Printing Inks Setup dialog box.*

A word of warning: In order for the values you've entered in Photoshop's Printing Inks Setup dialog box to take effect, you must print in CMYK mode. Sending the image to your printer as RGB data leaves the color conversion process to the printer driver and, in this case, that's something I wouldn't recommend.—*Luisa Simone* □

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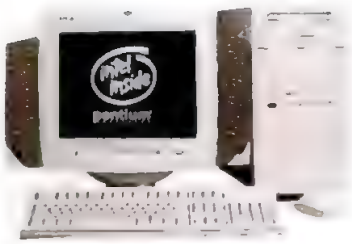

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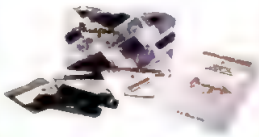

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	8MB	190597-001	$319
	16MB	190598-001	$599
Contura 4/25, 4/33	4MB	144790-001	$149
	8MB	144790-002	$269
	16MB	144790-003	$599
LTE Elite 4/40, 4/50, 4/75	4MB	199013-001	$149
	8MB	199015-001	$309
	16MB	199017-001	$595
Contura 400, 410, 420, 430	4MB	147653-001	$159
	8MB	147655-001	$289
	16MB	147657-001	$649
Elite 5000	8MB	213515-001	$319
	16MB	213515-002	$599
	32MB	213515-003	$1,125
	64MB	213515-004	$2,199

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Model	MB	Part No.	Price
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	16MB	310-3436	$549

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	8MB	84G5692	$269
	16MB	84G5995	$599
ThinkPad 365, 365CD	4MB	92G7287	$159
	16MB	92G7293	$639
ThinkPad 701	4MB	04H6193	$159
	8MB	04H6194	$319
	16MB	04H6195	$639
ThinkPad 700, 720	4MB	07G1419	$170
	8MB	07G1420	$399
	16MB	07G1421	$589
ThinkPad 760, 760CD	8MB	92G7316	$339
	16MB	92G7316	$629

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	8MB	OP-4101202	$309
	16MB	OP-4101203	$629
Versa V, M, P, 4000, 4050, 4080	4MB	OP-4104001	$149
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Extensa 550, 550CD, 560, 560CD	8MB	9809810-0001	$299
	16MB	9804841-0001	$639
	32MB	9809811-0001	$1,199
TM5000, 5010, 5030, 5100, 5200	8MB	9798816-0001	$319
	16MB	9798816-0002	$749
TM 4000M	4MB	9793357	$179
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T1900, T4600, T4700, T4800 T4850 T4900	4MB	PC-PA2012U	$143
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	16MB	PC-PA2014U	$628
T3400, T3600	32MB	PC-PA2015U	$1,199
	4MB	PC-PA2019U	$149
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	16MB	NW2032U	$749
	32MB	NW2034U	$1,399
Tecra 700	8MB	NW2035U	$429
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	32MB	NW2037U	$1,899

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	8MB	501392-002	$259
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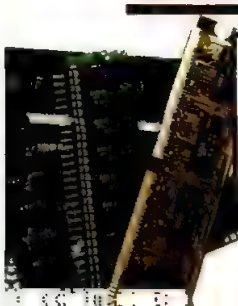

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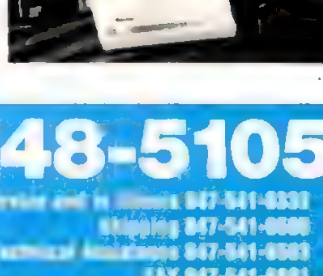

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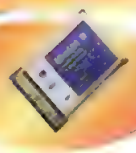

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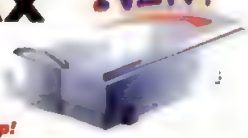

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Artisoft

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LANtastic II 10BT
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EtherExpress PRO 10/100B 10BT
EtherExpress PRO 10/100B 10BT Sca
EtherExpress PRO 10/100B BNC
EtherExpress PRO 10/100B BNC Sca
EtherExpress PRO 10/100B AUI
EtherExpress PRO 10/100B Flash
EtherExpress MCA 10BT
EtherExpress 16 C/TP
EtherExpress 16 combo
EtherExpress EISA 10BT
EtherExpress Flash combo
EtherExpress Flash combo Sca
Token Express PRO-5/4 LAN adapter
Network Express FL Ethernet

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Ethernet combo
Ethernet combo
Ethernet AUI 10BT
Ethernet AUI 10BT Sca
Ethernet BNC
Ethernet BNC Sca
Ethernet AUI BNC
Ethernet AUI BNC Sca
Ethernet Pocket + AUI
Ethernet TPLB 8 port + BNC
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Diamond Multimedia K1 4400 4X CD
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Microsoft Sidewinder 4X CD drive & sound
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NEC 4X
NEC 4x4 4X 4 disc changer
Panasonic 8X CD drive
Pioneer 4X internal
Sony PRO 150 portable PCMCIA CD
Sony 4X internal IDE interface
Sony 4X internal SCSI interface
Toshiba 4018 SCSI 2X internal
Turtle Beach Tropez
Turtle Beach TBS 4001 4X 4 speed

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Desktop GlidePoint
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Drawing Slate II 1212 4 button cordless

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Action Scanner II System
ES 1000C
ES 1200C Pro PC

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ScanJet 4C
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Summagraphics 1212 4 button
Summagraphics 1212 4 button

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Visioneer

PaperPort VX

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Magnavox 20CM4 .28 1280
Magnavox CM4000 .28 1600
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NEC XE15
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Diamond Stealth 64 VLB 1MB
Diamond Stealth Video PCI 2MB
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Diamond Edge 230XI 2MB VRAM
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Vi 28 8K V 34 internal w/fax & voice
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New Media Wave Jammer sound card
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Simple Tech SCSI adapter
Simple Tech 170MB hard drive
SMC Elite Ethernet combo
USR Sportster 14 4K
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Extensa 550 CD P5-75, Dual Scan	008835	2869
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TravelMate 5000 P5-75, Dual Scan	008831	2319
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TravelMate 5200 P5-120, Active Matrix	008858	4587
Toshiba		
Portégé P5-90, Active Matrix	008915	$3999
Satellite DX4-75 w/500 Mb HDD, Dual Scan	008918	1945
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Tecra 700 P5-120, Dual Scan	008937	4575

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T1900, T1950, T4500, T4600, T4700, T4800 & T4900
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CL57SX, Thinkpad 510, 700, 700C, 720, & 720C
4MB $169
8MB $339

Thinkpad 220, 230Cs
4MB $239
8MB $410

Thinkpad 300
8MB $385

Thinkpad 340, 355, 360, 730
4MB $189
8MB $320
16MB $569

Thinkpad 701
4MB $189
8MB $339
16MB $629

Thinkpad 710T
4MB $185
8MB $317

Thinkpad 750, 755
4MB $209
8MB $389
16MB $619
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PS Note 486
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Contura 400, 410
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Contura 4/25 Series
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8MB $299
16MB $639

LTE Lite/20,25,25c
4MB $215
8MB $385

LTE Lite 4/20c
4MB $215
8MB $399

LTE 5000
8MB $399
16MB $705
32MB $1386

NEC

Versa S, Versa 2000
4MB $175
8MB $319

Versa E, M, V, P
4MB $185
8MB $339
16MB $569
32MB $1299

Ultra Lite Versa
4MB $225
8MB $389
16MB $799

Versa 4000
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16MB $599
32MB $1429

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6MB $257

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NoteJet 486 (Original), NoteJet II 486C
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NoteJet 486 33, 33c, 25c, Innova 486 NX
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8MB $389

Innovabook 1100
8MB $329
16MB $640

Innovabook 150C
4MB $189
16MB $619

Innovabook 200LS
4MB $192
8MB $389
16MB $809
24MB $999

OTHERS

Apple Powerbooks	ALL MODELS	CALL
TI TravelMate 4000	4MB	$189
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AST Ascentia 800n	4MB	$185
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	16MB	$689
AST Ascentia 900n	4MB	$205
	8MB	$355
	16MB	$609
AST PremExec	4MB	$159
AST PowerExec	4MB	$179
	16MB	$769
AST Bravo MB 486	4MB	$206
	16MB	$947
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Brother	ALL MODELS	CALL
Canon	ALL MODELS	CALL

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2MB MD $119
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16MB MD $609

Epson Action Laser II EPL 8000
2MB MD $129
4MB MD $205

Epson EPL 6000
4MB MD $189

HP LaserJet II, IID, IIP, IIL IIID
2MB BD $95
4MB BD $169

HP LaserJet 4L
1MB MD $49

HP LaserJet 4, 4M, 4P, 4si, 4siMX
IIIsi,XL 300,DJ 1200C, Design Jet 600
4MB MD $179
8MB MD $351

HP 5P 5MP
4MB MD $179
8MB MD $351
16MB MD $689

HP 5L
4MB MD $189
8MB MD $369

HP Deskjet
500,500C,520,520C,550C,560,560C
256K MD $59

IBM 4019 4019e
2MB MD $109
3.5MB MD $169

IBM 4029 4039 4079
2MB BD $89
4MB BD $159

NEC Silent Writer 95 97
2MB BD $100

Oki Lasers
ALL MODELS ..... CALL

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4MB MD $189

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1MB SRAM Card With 2K Attribute	$125
2MB SRAM Card With 2K Attribute	$219
2MB Flash Card	$135
4MB Flash Card	$219
8MB Flash Card	$359
16MB Flash Card	$595
14.4/14.4 Fax/Modem	$129
28.8/14.4 Fax/Modem	$259
10-Base T Network Adapter	$129
Internal Desktop Card Reader	$135
SCSI II PCMCIA Adapter	$129

MEGAHERTZ

14.4/14.4 X JACK Fax/Modem	$175
28.8/14.4 X JACK Fax/Modem	$365
Ethernet/14.4 Fax Modem Combo	$389

IBM

20MB Flash Card Type 1	$835
30MB Flash Card Type 2	$1345
60MB Flash Card Type 2	$1720

PCMCIA HARD DRIVES

170MB Integral	$338
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340MB Integral	$535

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PCMCIA CD-ROM

AXONIX PROMEDIA PRODUCTS ARE EASY TO INSTALL AND CAN PROVIDE SOUND & MULTIMEDIA TO YOUR LAPTOP COMPUTER SYSTEM. THE PROMEDIA PLAYER HAS BUILT IN 16-BIT SOUND AND AMPLIFIED SPEAKERS. THE PROMEDIA READER IS CD-ROM ONLY AND WORKS GREAT WITH SYSTEMS THAT ALREADY HAVE BUILT IN MULTIMEDIA CAPABILITIES.

SX CD-ROM W/16-BIT SOUND	$539.00
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4X CD-ROM PLAYER	$459.00
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386SX 16/20 MHZ DX to 486 40/50 MHZ MB Cache	$229
386DX 25/33 MHZ DX to 486 50/66 MHZ MB Cache	$279
386DX 33 MHZ DX to 486 66 MHZ MB Cache	$489

TI

386DX 33 MHZ (X1) to 486 33 MHZ	$129
386DX 40 MHZ (X1) to 486 40 MHZ	$149

INTEL

486DX/5X To Pentium 63MHZ (W/Socket)	$279
486DX/5X To Pentium 63MHZ (W/Socket)	$299
486DX/5X-33 MHZ (X2) 486-100 MHZ	$225
486DX/5X-25 MHZ (X2) 486-75 MHZ	$169
486DX/5X-33 MHZ (X2) 486-66 MHZ	$152
486DX/5X-25 MHZ (X2) 486-50 MHZ	$129

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Portégé 610CT

- Pentium 90MHz processor
- 9.5" True Color display for optimum color
- Built-in 16-bit sound (SoundBlaster Pro compatible) microphone & speaker
- Lithium Ion battery technology
- Accupoint stick for easy control

Processor	Screen	RAM/HD	Price
Pentium 90MHz	9.5" True Color	8/720MB	$3939

120MHz Pentium with PCI bus

BIG! 11.3" Screens

Tecra 700

- Pentium 120MHz processor
- PCI bus architecture for video & external
- 11.3" 800x600 high resolution display
- Optional ATI Mobility video, sound, modem & CD-ROM
- Multimedia docking station with PCI bus (optional accessory, priced separately)
- Built-in 16-bit sound, microphone, 2 speakers & MIDI
- HUGE 1.3GB hard drives

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Processor	Screen	RAM/HD	Price
Pentium 120	11.3" Dual Scan	8MB/1.13GB	$4679
Pentium 120	11.3" Active	16MB/1.13GB	5949

Tecra 700

Satellite Pro 410CT

Satellite Pro 410

- Built-in 4X CD-ROM drive (Swappable 6X CD-ROM optional models only – optional on Pro 410CDT)
- Built-in 16-bit sound, microphone, speaker & MIDI
- EDO RAM (expandable to 40MB)
- Built-in 4X adapter, small, sleek design & reduced weight
- Integrated Accupoint, small, accurate & easy to use
- Lithium Ion battery technology
- Built-in [illegible]

Processor	Screen	RAM/HD	Price
Pentium 90	11.3" Dual Scan	8/772MB	$3199
Pentium 90	11.3" Active	8/772MB	4399

Satellite 2130CS/100CS

Satellite 2130CS/100CS

Processor	Screen	RAM/HD	Price
486DX4/75	10.4" Dual Scan	8/500MB	$1599
Pentium 75	10.4" Dual Scan	8/500MB	1969*

*EDO RAM

IBM®

SPECIAL ThinkPad 701 Offer

Call for Details

ThinkPad 365

- 10.4" Active & 10.4" Dual Scan
- Built-in infrared for no-hassle printer connections
- Multimedia models include built-in 2X CD-ROM SoundBlaster compatible audio, speaker, microphone & MIDI joystick port
- MS Windows 95 or Seattle System models available

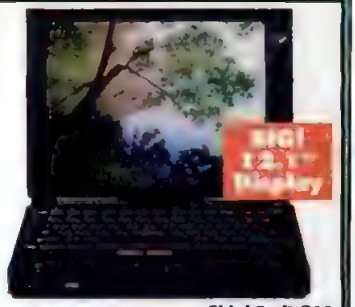
Processor	Screen	RAM/HD	Price
486DX4/75	10.4" Dual Scan	8/540MB	$1999
486DX4/75	10.4" Active	8/540MB	2599
486DX4/75	10.4" Dual Scan	8/540MB	2499*
486DX4/75	10.4" Active	8/540MB	3099*

*Features built-in 2X CD-ROM drive

ThinkPad 760

- Up to 120MHz Pentium with 32-bit local bus
- 12.1" Active display with 800x600 resolution (selected models)
- 4X CD-ROM drive, MPEG 2 support & full motion video (Hurricane 760CD models only *)
- Built-in 28.8 fax modem
- SoundBlaster-compatible audio & telephony
- Lithium Ion battery technology

Processor	Screen	RAM/HD	Price
Pentium 90	10.4" Active	8/720MB	$4999
Pentium 90	12.1" Active	8/720MB	5499
Pentium 120	12.1" Active	8/720MB	5699
Pentium 120	12.1" Active	8MB/1.0GB	5999
Pentium 90	12.1" Active	8MB/1.2GB	6699*
Pentium 120	12.1" Active	8MB/1.2GB	6899*



ThinkPad 760

*Features built-in 4X CD-ROM drive
WIN 95 models available. Call for details.

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HP OmniBook 600 NoteBook PC

HP OmniBook 600

- Weighs ONLY 3.8 pounds!
- Built-in 16-bit sound, microphone & speaker (Active model only)
- Built-in infrared for no-hassle printer connections
- Lithium Ion battery technology (Active model only)
- Instant "ON" ready to work state – lasts for months on a charge

Processor	Screen	RAM/HD	Price
486DX4/75	8.5" Dual Scan	8/340MB	$2200
486DX4/75	9.5" Active	8/340MB	2500

HP OmniBook 5500

- 133MHz Pentium with 32-bit PCI local bus
- 12.1" Active Matrix display with 65,000 colors
- Super VGA 800x600 resolution on notebook
- PCI Local Bus Video, 1.5MB video memory
- Instant-on capabilities
- Optional internal 4X CD-ROM available

Processor	Screen	RAM/HD	Price
Pentium 133	12.1" Active	8MB/1.35GB	CALL

133MHz Pentium processor

HP OmniBook 5500 Product differs slightly from photo

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Versa 2000

- Lithium Ion battery technology
- VersaGlide touch-pointer-simple & accurate
- Built-in, upgradable 14.4 fax modem (on selected models)
- LOADS of **FREE** software preinstalled

Processor	Screen	RAM/HD	Price
486DX4/75	9.5" Dual Scan	4/350MB	$1899*
486DX4/75	9.5" Active	8/350MB	2399
486DX4/75	9.5" Active	8/540MB	2599

*14.4 fax/modem not built-in

NEC Versa 2000

NEC Versa 4000

NEW Versa 4000 Models with 4X CD-ROM

NEC Versa 4000

- Built-in CD-ROM Drive! (Standard on some models, optional on others)
- Up to 120MHz Pentium processors
- 256KB Level 2 Cache to optimize performance
- Unbelievable displays – 65K color Dual Scan, 16.8 million color Active (High resolution Active Matrix displays available – 800x600 res.)
- Built-in 16-bit sound, microphone, MIDI and **2 built-in speakers**
- Multimedia docking station with outstanding Altec Lansing 4 speaker array (optional accessory priced separately)

Processor	Screen	RAM/HD	Price
Pentium 75	10.1" Active	8/810MB	$3799+
Pentium 90	10.4" High Res.	8/810MB	4499
Pentium 90	10.1" Active	8/810MB	4499+
Pentium 120	10.4" High Res.	8MB/1GB	4999

+ Features built-in 4X CD-ROM drive

ONLY $349.99

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4X Speed
7 CD Changer
CDR-C302

ONLY $279.99

NEC Multispin 4x4
4X Speed
Internal
4 CD Changer
CDR-C251

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Digital 4X Mobile Media Module $698.99

HiNote Ultra

- All models 4 lbs. or less - **ONLY 1.2" thick**
- Built-in sound, microphone & speaker
- Lithium Ion battery technology
- Built-in infrared
- 3-year warranty - **FREE** 1-year Passport Service

Processor	Screen	RAM/HD	Price
486DX2/50	9.5" Dual Scan	4/340MB	$2249
486DX2/50	9.5" Active	8/340MB	2829
486DX4/75	9.5" Dual Scan	8/528MB	2899
486DX4/75	9.5" Active	8/340MB	3099
486DX4/75	9.5" Active	8/528MB	3399

Built-In Audio!

HiNote Ultra
Shown with 4X Mobile Media Module, optional accessory priced separately

Complete lines of Digital Desktop & Server PCs available. call for details and pricing

COMPAQ

Contura 430

Processor	Screen	RAM/HD	Price
486DX4/100	10.4" Dual Scan	8/720MB	$2369
486DX4/100	10.4" Active	8/720MB	2939

LTE 5000 Series

- Up to 120MHz Pentium power w PCI bus & 256KB cache
- 32-bit PCI Local bus graphics
- 8MB RAM exp. to 72MB
- Built-in 16-bit sound, microphone & **2 speakers**
- MultiBay – holds CD-ROM, 2nd HDD, Floppy or 2nd battery
- Up to 1.35GB hard drives (2.7GB max. capacity)
- Built-in infrared for wireless communications
- Supports NiMH batteries
- Optional MPEG and TV video adapter

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Processor	Screen	RAM/HD	Price
Pentium 75	10.4" Dual Scan	8/510MB	$3799
Pentium 75	11.3" Dual Scan	8/810MB	4439
Pentium 75	10.4" Active	8/810MB	4729
Pentium 90	10.4" Active	8/810MB	5339
Pentium 90	10.4" Active	8/810MB	5599*
Pentium 120	10.4" Active	8MB/1.35GB	6149

*Features Built-in CD-ROM drive

UP TO 120MHz PENTIUM with PCI BUS

LTE 5000

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- 6X CD-ROM drive*
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- Super fast 64-bit PCI local bus graphics
- Built-in MPEG support for full screen, full motion video
- 32-bit PCI IDE controller – fast disk performance
- LOADS of **FREE** software

*4X CD-ROM on 7010

Processor	RAM/HD	CD-ROM	Price
Pentium 120	8MB/1.2GB	4X	CALL
Pentium 133	8MB/1.2GB	6X	CALL
Pentium 150	8MB/1.2GB	6X	CALL
Pentium 133	8MB/1.2GB	6X	CALL
Pentium 120	16MB/1.6GB	6X	CALL
Pentium 133	16MB/1.6GB	6X	CALL
Pentium 150	16MB/2GB	6X	CALL
Pentium 166	16MB/2GB	6X	CALL

Monitors priced separately

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150&166MHz PENTIUM

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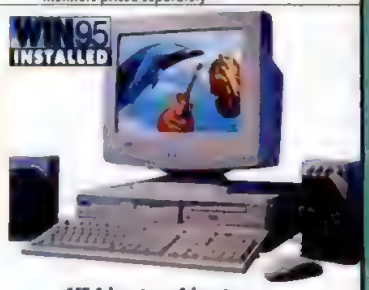
Advantage Adventure Multimedia (6X CD-ROM)

- 6X CD-ROM Drive
- 6X CD-ROM Drive w/ 3disc CD changer (selected models)
- Advanced Telephony – 28.8 data fax modem, telephone answering system and speaker phone (differs by model, call for details)
- Integrated 3-D surround sound (most models)
- 64-Bit PCI Local bus graphics
- AST Works II navigation software – featuring SPOT
- Enhanced IDE interface
- AST Lifeline technical support

All New Models!

Processor	RAM/HD	CD-ROM	Price
Pentium 100	16MB/1.2GB	6X	$2020
Pentium 133	16MB/1.2GB	6X	2150
Pentium 150	16MB/1.6GB	6X	2370
Pentium 100	16MB/2GB	6X	2050
Pentium 133	16MB/1.6GB	6X	2300
Pentium 150	16MB/2.1GB	6X+	2640
Pentium 166	16MB/2.1GB	6X+	2830

+w/3disc CD changer, *Monitors priced separately*



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Digital Starion

Digital Starion

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- 4X CD-ROM Drive
- up to Pentium 166 – blazing speed!
- PCI local bus – ultra speed graphics
- Unbelievable sound – SoundBlaster Pro compatible, SW Wave Table, Premium JBL speaker system
- 28.8 fax modem and advanced telephony features (differs by model)
- Loads of **FREE** software preinstalled

All New Models!

Processor	RAM/HD	CD-ROM	Price
Pentium 75	8MB/1.2GB	4X	$1599
Pentium 100	8MB/1.2GB	4X	1759
Pentium 100	16MB/1.6GB	4X	2099
Pentium 120	16MB/1.6GB	4X	2299
Pentium 133	16MB/1.6GB	4X	2499
Pentium 150	16MB/1.6GB	4X	2599
Pentium 166	16MB/1.6GB	4X	2799

Monitors priced separately

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or SAVE 10%

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SAVE 30%

$229

HP LaserJet Printers

HP LaserJet 5P printer (IBM, 6ppm, 600dpi) C3150A	$879.99
HP LaserJet 5L printer (IBM, 4ppm, 600dpi) C3941A	479.00

HP InkJet Printers

HP DeskJet 340 printer (portable) C2655A	$289.99
HP DeskJet 340 CV (bundle) C2664A	329.99
HP DeskJet 320 (bundle) C2637A#ABA	229.00
HP DeskJet 600 printer C2184A	289.99
HP DeskJet 600C printer C4547A	299.99
HP DeskJet 660C printer C2164A	389.99
HP DeskJet 660Cse printer C4548A	399.99*
HP DeskJet 855C printer C4551A	498.99*
HP DeskJet 1600C printer C3540A	1349.99

Home Office Products

HP OfficeJet C2890A	$599.99
HP OfficeJet LX C2891A	689.99
HP FAX-700 C3530A	509.99

*Includes Family Font Package

Hewlett-Packard Scanners

HP ScanJet 4C scanner C2527B	$949.99
HP ScanJet 4S portable scanner C1127A	319.00

HP Tape Drives

HP T1000 (internal) C4320RB	$179.99
HP T1000e (portable) C4326RB	219.99
HP SureStore, 2GB, DAT, Int C1525F	939.99
HP SureStore, 2GB, DAT, Ext C1520F	1099.99
HP SureStore, 4GB, DAT, Int C1526F	1079.99
HP SureStore, 8GB, DAT, Int C1528F	1329.00
HP SureStore, 8GB, DAT, Ext C1529F	1529.00

HP LaserJet 5L $479.00

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- Power TranXit
- America Online
- Compuserve

PC-3020

Sharp PC-3020/PC-3060

- GlidePoint™ pointer — the latest technology the easiest to use
- Built-in infrared for wireless communications
- 32-bit VESA Local bus graphics
- Built-in 16-bit SoundBlaster compatible sound, microphone & 2 speakers (PC-3060 only)
- Built-in 14.4Kbps voice/data/fax modem (PC-3060 only)

NEW MODELS!
Call for details and pricing

Processor	Screen	RAM/HD	Price
5x86 100MHz	10.4" Dual Scan	8/515MB	$1900
5x86 100MHz	10.4" Dual Scan	8/515MB	2200*

Model PC-3060. Includes built-in sound system & 14.4 voice/data/fax/modem

What makes a notebook smarter

Texas Instruments

75MHz Pentium with PCI bus

WIN95 INSTALLED

Extensa 560CD/560CDT

- 75MHz Pentium w PCI bus & 256KB cache
- Built-in 4X CD-ROM drive
- Built-in 16-bit sound, microphone & speaker
- Integrated Touchpad pointer
- 10.4" Active Matrix & 10.4" Dual Scan
- Built-in infrared for wireless communications

Processor	Screen	RAM/HD	Price
Pentium 75	10.4" Dual Scan	810MB	$2749
Pentium 75	10.4" Active	1.2GB	3699

Extensa 560 Product differs slightly from photo

TravelMate 5100/5130/5200/5270

NEW MODELS!

Processor	Screen	RAM/HD	Price
Pentium 90	10.4" Active	8MB/1.2GB	$3399
Pentium 90	10.4" Active SVGA	8MB/1.2GB	3699
Pentium 120	10.4" Active SVGA	8MB/1.2GB	4649
Pentium 120	11.3" Active SVGA	8MB/1.2GB	5079

SVGA-800 x 600 resolution

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Ascentia J

NEW

AST Ascentia J

- Integrated 14.4/14.4 Data/fax modem
- PCI bus architecture with 256KB L2 cache memory
- 10.4" SVGA (800x600) resolution Dual Scan and Active Matrix displays

Processor	Screen	RAM/HD	Price
Pentium 75	10.4" Dual Scan SVGA	8/500MB	$2450
Pentium 100	10.4" Dual Scan SVGA	8/800MB	2840
Pentium 100	10.4" Active Matrix SVGA	8/800MB	3120

Ascentia 950N

Processor	Screen	RAM/HD	Price
Pentium 75	10.4" Active	8/800MB	$2560
Pentium 75	10.4" Active	8MB/1.2GB	2880
Pentium 90	10.4" Active SVGA	8/800MB	3430
Pentium 90	10.4" Active SVGA	8MB/1.2GB	3750
Pentium 120	11.8" Active SVGA	8/800MB	4469
Pentium 120	11.8" Active SVGA	8MB/1.2GB	4849

Additional 950N models available. Call for details.

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CLN1

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$99.99

CS01

Sherpa

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Universal Carrycase	CUN1	$69.99
Backpack Carrycase	CGB1	69.99
Leather Carrycase	CLN1	99.99
Encore Nylon Carrycase	CEN1	99.99

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28.8/14.4
PCMCIA
XJ3288

$325.00

Mode	Description	Price
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CC3144	14.4/14.4 PCMCIA	99.00
XJ2144	14.4/14.4 XJACK GOLD	115.00
CC4144	14.4/14.4 PCMCIA GOLD	139.99
XJ2288	28.8/14.4 XJACK	299.99
CC3288	28.8/14.4 PCMCIA	299.99
XJ3144	14.4/14.4 XJACK Cellular•Modem	150.00
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T3100SX T3200SX	2Meg	PC15-PA3006U	109.00
T3100SX T3200SX	4Meg	PC15-PA3010U	189.00
T800 610 CT	8Meg/16Meg/32Meg		299/585/1150
T700	8Meg/16Meg/32Meg		349/649/1299
T400CS 400CD*	8Meg - 64Meg/32Meg		299/585/1150

NOTEBOOK, LAPTOP MEMORY

MODEL	AMT UPGRADED	MANU. PART #	PRICE
ACER 730 735C 780 780	2Meg 4Meg 8Meg		89/139/279
ACER 725 725L 740 740L 740L 767	4Meg/8Meg/16Meg		139/268/524
ACER 750	4Meg/8Meg/16Meg		139/268/524
ACER Note Pro ACER Note Lite	4Meg/8Meg/16Meg		139/268/524
AST Ascentia 800N, 810N	4Meg/8Meg/16Meg		139/268/524
AST Ascentia 950	4Meg/8Meg		299/534
AST Bravo & Explorer	4Meg/8Meg	807295-001 -002	139/534
AST Notebook Pro Exec 3000/3100/3200LL		500814-003	139.00
AST Power Exec 4/25SL, 4/25SL, 4/25SL	4Meg/16Meg	501018-001 -003	139/619
AST Power Exec 4/33SL	4Meg/16Meg	803378-001 002	149/519
AT&T Globalyst 130	4Meg/8Meg		139/289/534
AT&T Globalyst 200 (Call for other Globalyst)	4Meg/8Meg		139/289/534
AT&T Safari NSX20	4Meg	PEC 37881	219.00
Austin DX4 D32 S32 SX Series	4Meg 16Meg		136/539
Bondwell B310 Plus	1 Meg	23080-08100	59.00
Bondwell B310N SX	4Meg		208
Canon innova Book 150	4Meg		139/549
Canon innova Book 200LS	4Meg/8Meg/16Meg		139/289/549/999
Canon innova 486	2Meg 4Meg 8Meg		89/139/299
Canon innova 486-10	4Meg		139/549
Canon Notevet 486	4Meg 8Meg		139/289
Canon Notevet DX4/75	4Meg/8Meg		139/289/579
DEC Hinkley Jora Hotlista	4Meg/8Meg		139/289/549
Dell Latitude LX 4100D XP 4100D	4Meg/8Meg		139/289/549
Dell Latitude M MCX	4Meg/8Meg		139/289/549
Dell Latitude XP 475 4100 4100CX	8Meg		139/549
Dell Latitude 486 425 433X 433CX 450 450CX	4 Meg 16 Meg		139/549
Epson Actionnote 650 650c 560c 660cx	4Meg/8Meg/16Meg		139/289/549
Epson Actionnote 700 700c 700cx	8Meg		139/549
Epson Actionnote 800 800c 800cx	4Meg/8Meg/16Meg/20Meg		139/289/549/599
Epson Actionnote 880	4Meg/8Meg		139/289/549
Epson Actionnote 4000 Notebook			229
Epson Actionnote 4L C/25 4LC/33 4SLC/2-50			229
Gateway Tranport, CD Carrier		PCA 00000-0001	89.00
Gateway 2000 Colorbook 4/33	4Meg/16Meg		149/524
Gateway 2000 Revised 4/33 Duo, 25L	4Meg/16Meg		149/549
Gateway 2000 486 Handbook or Liberty	4Meg/16Meg		149/549
Gateway 2000 Solo Series	8Meg/16Meg/32Meg		Call
HP Omnibook 300 400 425	2Meg 4Meg		89/149
HP Omnibook 530 600	4Meg/8Meg/16Meg		139/299/499
HP Omnibook 4000	4Meg/8Meg/16Meg		139/289/549
HP Omnibook 5000	8Meg/16Meg/32Meg		289/549/1199
Leading Edge Ambo 2000			139/549
Lasmark 5510	4Meg/8Meg		179/319
Magnavox Matador	1Meg/4Meg	286 386SX	89/139
Mitsubishi Micro Elite SX 25 S33 D32-50 D32-80	4Meg/8Meg/16Meg		149/289/549
Mitsubishi Micro Elite SX33 S33 D33 D33-80	4Meg/8Meg/16Meg		149/289/549
Mitsubishi Micro Elite Solo Plus D5 75 D5 90	4Meg/8Meg/16Meg		149/289/549
NCR Safari 3150 3181	4Meg & 8Meg		159/299
NEC Ultralite Versa E V MP	4 Meg/8Meg/16Meg/24Meg	DP4104	149/315/579/899
NEC Versa Removeable Hard Drive	710Meg/1.0Meg/1.3 Gig		730/750/753
NEC versa S	4Meg/8Meg/16Meg		39/299/579
NEC versa 2000C & 2000D	4Meg/8Meg		139/289/549
NEC Versa 4000	4/8/16/32Meg		139/289/549/1199
Packard Bell 386SX 286	1Meg	286, 386SX	109/179
Packard Bell Statesman	2Meg/8Meg		89/209
Panasonic 7170 P2220 CP200	1Meg	CF-BA100	59.00
Panasonic 3700 CP400	2Meg/4Meg		99/109/289
Panasonic CF-V21P CF-500	2Meg		89/209
Panasonic CF-141	4Meg/8Meg/16Meg		139/289/549/1099
Sanyo 17 18 MB	2Meg	MBC-MBMEM2	89.00
Sharp 6781 6881 6780 6780 6880 6741	2Meg 4Meg		89/149
Sharp 8150 8880 8680 7780 7780	4Meg		149/569
Sharp 9740 9760	4Meg/8Meg		139/289/549
Sharp PC310 PC350 3010 & 3050	4Meg/8Meg		139/289/549
Ti Travelmate 2000	1Meg	2500034-0001	79.00
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TI 4000	4Meg 16Meg		149/779
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Tandy 1510 1520	1Meg		89/149
Tandy 2500 3000 3030	2Meg/4Meg/8 Meg		89/149/299
Toshiba Ultra Compatible 486SX, DX Tandy 4000	4Meg/16Meg		149/549
Toshiba Slimnote 5	4Meg/8Meg		149/289/549
Ultra 486 "SX"	4Meg/8Meg		149/289/549
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Zenith Super Sport 286 286E	1Meg	ZA-180-86	99.00
286E SX	2Meg	ZA 180-84	99.00
SX Alpha SX Beta	2Meg	ZA-180-86/ZA-180-87	99.00
Zenith Z Note 425LX LRC LNP	2Meg		139.00
Zenith Z Star 4/33	2Meg 8Meg		89/209
Zenith Z Star EX	4Meg/8Meg/16Meg		149/279/549

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AMOUNT UPGRADED	OK Ok!	256K	1	2	3	3.5	4	5	6	8	16	32
Brother 630 631 641 645	-	89	139	-	-	-	-	-	-	-	-	-
Canon LBP 430	-	69	-	89	-	99	-	-	-	-	-	-
Canon LBP 860	-	-	89	-	-	99	-	-	199	399	699	-
Canon LBP4 4Lite Alpha	-	129	179	-	-	-	-	-	-	-	-	-
Epson 6000 Action Laser	-	-	229	-	-	-	-	-	-	-	-	-
Epson Action Laser 1100 1800	-	69	70	-	-	99	-	-	199	399	-	-
Epson Action Laser 2000	-	79	-	179	-	-	272	-	-	Call	Call	Call
Epson 8000 1800 4000 4100 4300	-	89	-	179	-	-	272	-	-	Call	Call	Call
Epson 1000 1500 2000 3000	-	-	199	-	-	249	-	-	-	-	-	-
HP 2 2D	-	-	79	-	-	119	-	-	-	-	-	-
HP 3 3D 3P 3P 2P+	-	-	79	-	-	119	-	-	-	-	-	-
HP 4 4M 4Si 4SiMX	-	-	59	-	-	109	-	-	209	-	-	-
HP 4P 4PLUS 4MPlus 1000 1000CM	-	-	-	-	-	89	-	-	179	-	-	-
HP 4L	-	59	-	-	-	-	-	-	-	-	-	-
HP 3Si	-	89	-	-	-	109	-	-	209	-	-	-
HP 4Si	-	-	89	-	-	109	-	-	209	-	-	-
HP 5L	-	59	89	-	-	149	-	-	299	-	-	-
HP 5P	-	-	89	-	-	109	-	-	171	334	-	-
HP Design Jet 600 850 200	-	-	-	-	-	109	-	-	209	-	-	-
HP Deskjet 500 500C 510 500 550	40	-	-	-	-	-	-	-	-	-	-	-
HP Deskjet 1200C 1200C/P	-	-	69	-	-	109	-	-	209	-	-	-
HP Paintjet XL300	54	-	-	-	-	149	-	-	299	599	-	-
IBM Laser 4019 4019E	-	-	-	-	139	-	-	-	-	-	-	-
IBM Laser 4029 4037	-	-	-	-	-	139	-	-	-	-	-	-
IBM Laser 4028 4029	-	-	69	-	-	139	-	-	209	-	-	-
Konica LP 3110	-	119	189	239	-	-	-	-	-	-	-	-
Lasmark Optra L LX, R, RX	-	-	-	-	-	89	-	-	171	334	699	-
Lasmark [illegible] 300 [illegible]	-	49	69	-	-	109	-	-	-	-	-	-
Lasmark [illegible] 202, 403 [illegible]	-	59	89	-	-	109	-	-	-	-	-	-
[illegible]	-	-	[illegible]	-	-	-	-	-	-	-	-	-
[illegible]	-	-	[illegible]	-	-	-	-	-	-	-	-	-
Oki 400E	-	-	-	-	-	-	-	-	-	-	-	-
Oki 405E 405EX 410E 410EX	-	89	129	169	-	219	-	-	-	-	-	-
Oki 830 840	-	-	109	-	-	-	-	-	-	-	-	-
Packard Bell PB 8500	-	-	139	-	-	227	-	-	-	-	-	-
Packard Bell 9815	-	-	139	-	-	229	-	-	-	-	-	-
Panasonic 4420/4450	-	-	129	-	-	229	-	-	-	-	-	-
Panasonic 4410/4430	-	-	129	-	-	179	-	-	-	-	-	-
Panasonic 4450	-	99	-	-	-	-	-	-	-	-	-	-
Panasonic 4400/5400	-	89	129	-	-	229	-	-	-	-	-	-
Panasonic 4430 5410 6500	-	89	129	-	-	229	-	-	-	-	-	-
Sharp 9400 9460 [illegible] 9700E	-	89	119	-	-	219	-	-	-	-	-	-
Sharp 9500 E H, 9700 H	-	79	-	-	-	259	-	-	-	-	-	-
TI XL PS17 PS35	-	49	-	-	-	-	-	-	-	-	-	-
TI Microlaser Pro E Pressmark Pro 830	-	89	139	-	-	229	-	-	429	-	-	-
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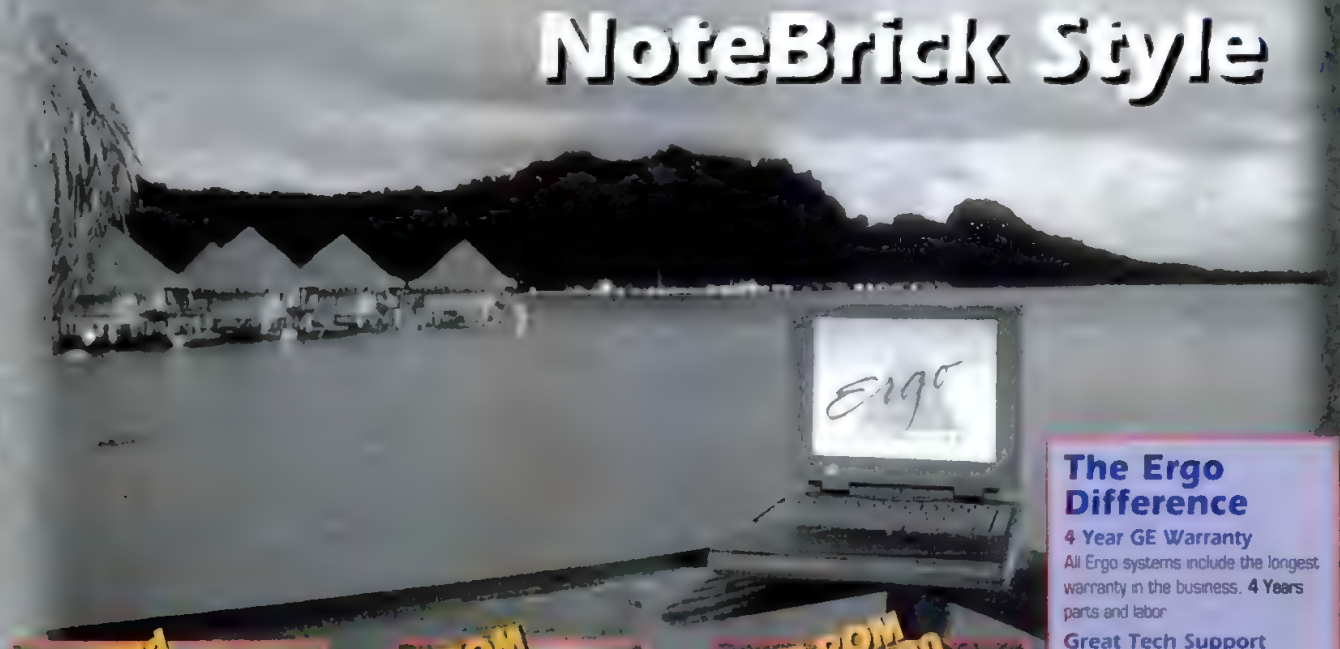

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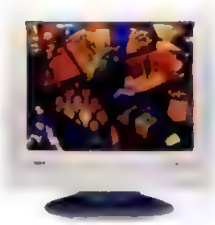

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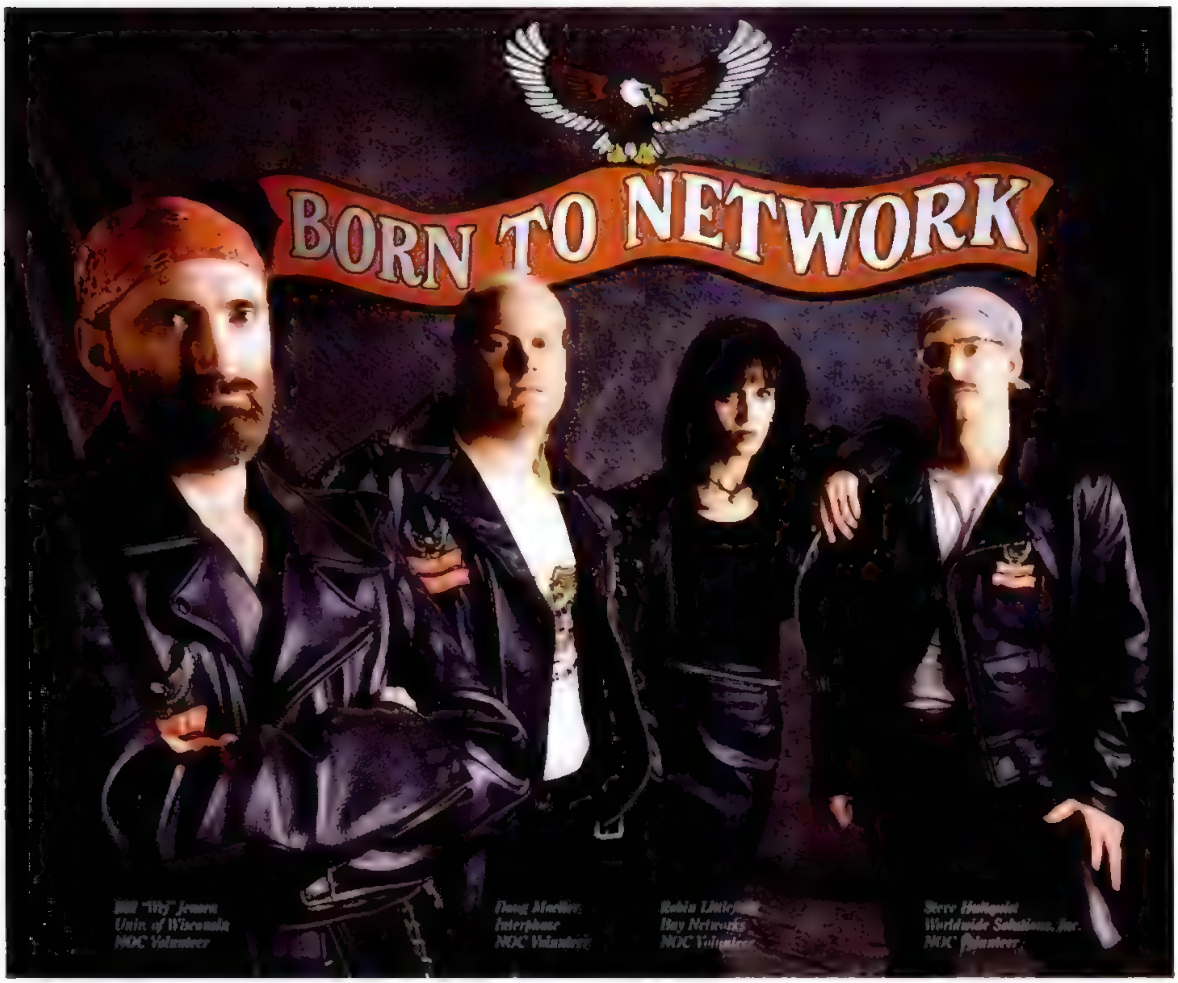

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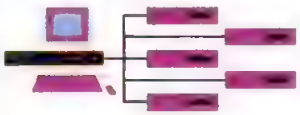

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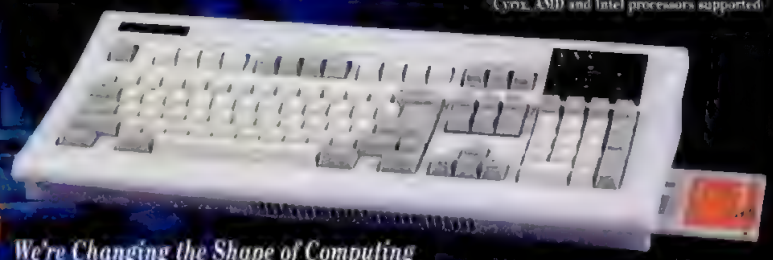

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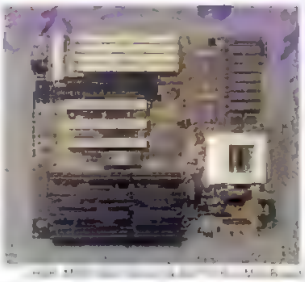

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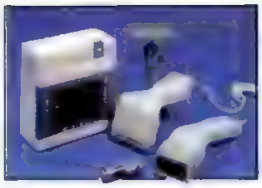

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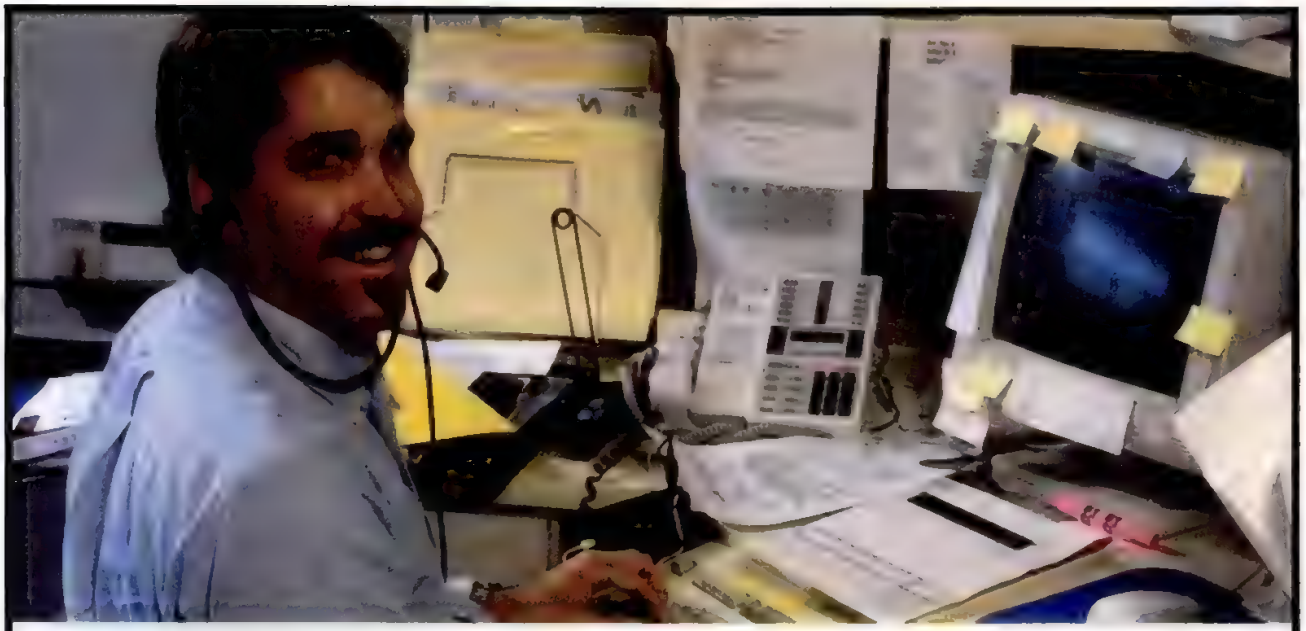

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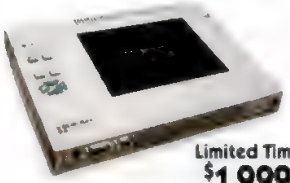

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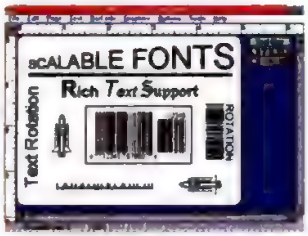

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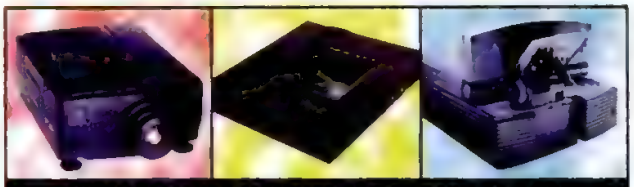

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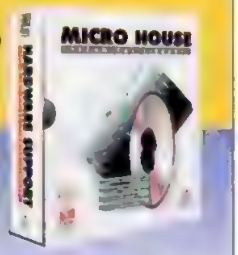

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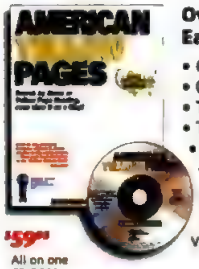

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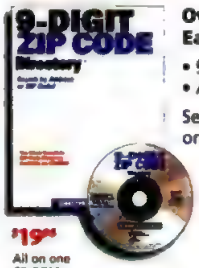

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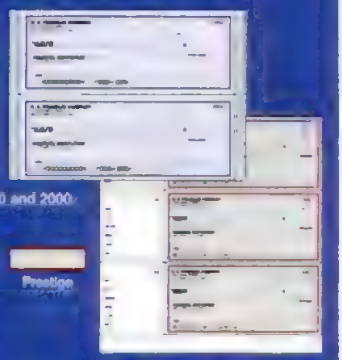

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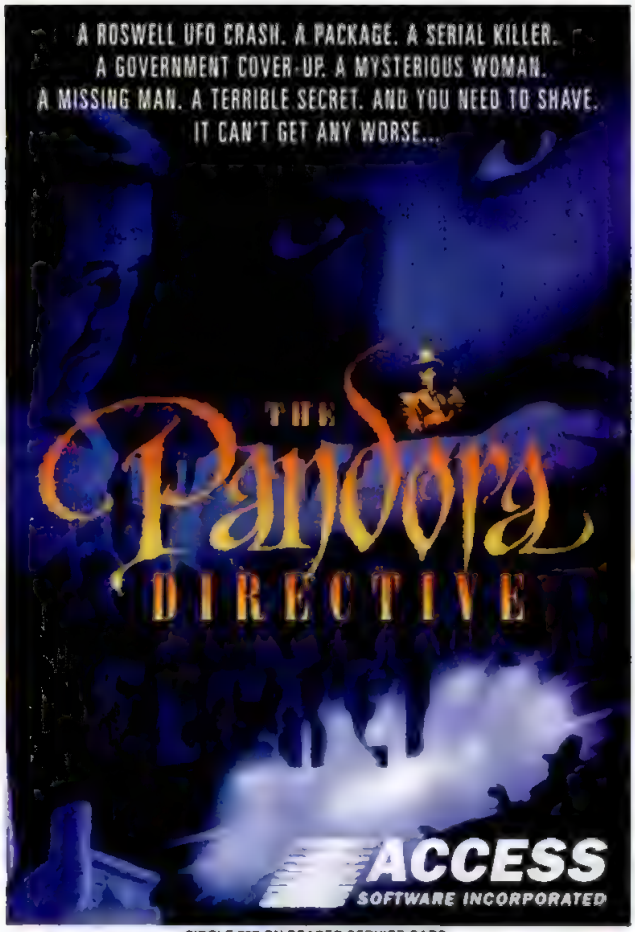
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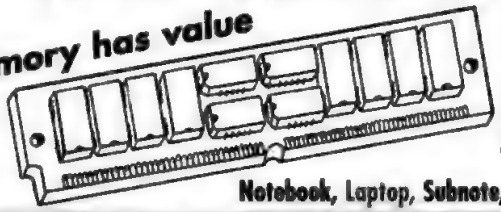

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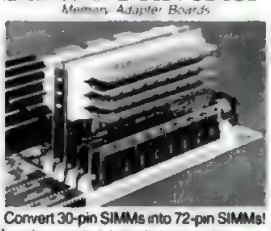

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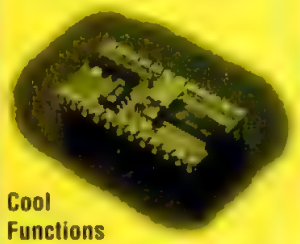

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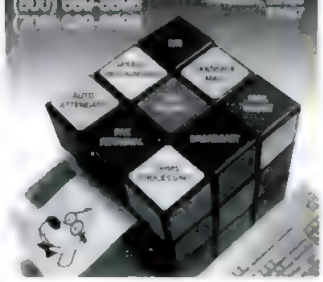

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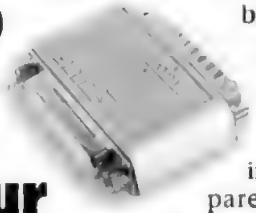

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CIRCLE 649 ON READER SERVICE CARD

CYBER IMAGES

Live Adult Video Phone Sex
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Using your PC and modem You will receive a live, full motion image of a beautiful woman in the privacy of your own home. Interact with her in a one on one text chat or speak to her live while viewing her on your PC. $9.95 startup fee.

One step away from the real thing.

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must be 21+ 1-800-95-CYBER

CIRCLE 615 ON READER SERVICE CARD

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GIRLS!
GIRLS!

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SEE, HEAR & SPEAK!

Live 1 on 1
Voyeur Room to Room!
Famous P★rn Stars Performing Soon!
FREE iView Software!
Plus More . . . and More to Come!

Access Our Girls 2 Ways:
http://www.xxxsex.com
or modem in at 800-700-8205

Must be 18 Years or Older

CIRCLE 617 ON READER SERVICE CARD

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An On-Line Service For Adults

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Amateurs • Swimwear • Lingerie
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Local Access Available in over 1000 cities throughout the U.S. and Canada
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CIRCLE 619 ON READER SERVICE CARD

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http://www.adultsex.com

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ALWAYS FREE!!!

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All Welcome To Chat

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(Must be 21+)

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SOURCE 10620

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1-217-792-3663

Must be 18+. USE YOUR MODEM TO DIAL C/S Voice Line 415-281-4429

CIRCLE 618 ON READER SERVICE CARD

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SEXY CD-ROMS
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WITH EACH CD-ROM: $49 EACH OR 3 FOR $129

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SexCapades premiere adult board game 80 VGA scenes + sound $79
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CIRCLE 616 ON READER SERVICE CARD

PC MAGAZINE MARKETPLACE BUSINESSCARD

PC Magazine's BusinessCard section is a forum for innovative, hard-to-find and low-cost PC products and services. Ads are listed by product category and include Reader Service numbers to allow fast, easy response.

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1 issue–$990, 3 issues–$865, 6 issues–$840,
12 issues–$795, 17 issues–$750, 22 issues–$740.
Multiple-ad per issue rates also available. Prepayment must accompany each insertion. VISA/MC welcomed.

AD FORMAT:
PC Magazine will typeset each BusinessCard ad. Advertisers should furnish typewritten copy. Ads include: 1) Headline (1 line, initial caps=30 characters max, all caps=25 characters max), 2) Descriptive copy (5 lines, 225 characters max), 3) Company name (same specifications as headline), and 4) Address and telephone number (2 lines, 40 characters per line). No logos, artwork or camera-ready ads. Publisher reserves the right to edit supplied copy to meet section specifications.

DEADLINES:
PC Magazine is published 22 times a year, (bimonthly except for July and August). The BusinessCard closing is approximately two months prior to issue date.

Please send copy and payment to:
PC Magazine BusinessCard
One Park Avenue, 3rd Floor
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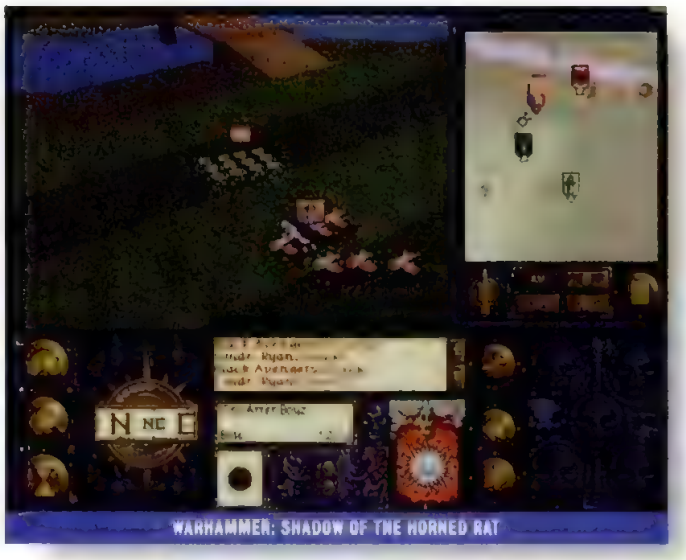
After Hours

EDITOR'S RATINGS: ★ Poor ★★ Fair ★★★ Good ★★★★ Excellent

DOS | Windows | Windows 95 | CD-ROM | Resource-Intensive | Adult Content | Kids (Ages) | Price

Time to Employ a Little Strategy

A good strategy game is hard to find—unless you look at some recently released PC titles, that is. Strategy games for the PC are common and popular, so it's not all that surprising when one truly excellent title comes along. In this story, we'll tell you about three such titles. Warhammer: Shadow of the Horned Rat is a brilliant, real-time fantasy war game. Warcraft II: Tides of Darkness, like Warhammer, is another excellent real-time game with a fantasy theme. Lastly, Allied General is a traditional, turn-based war game set in World War II. Each of these games is challenging and addictive. Play them at your own risk, however, as they are likely to cause many a sleepless night.


WARHAMMER: SHADOW OF THE HORNED RAT

Warhammer: Shadow of The Horned Rat

Mindscape; 800-234-3088; http://www.mindscape.com.

Circle 441 on reader service card.

★★★★ $50

Two more regiments of Skaven warriors just marched into sight. Your cavalry is engaged with a pack of Orcish archers and your infantry has its hands full with the first two Skaven regiments. The Black Avengers are little more than a local militia with no fighting experience—but they are your only reserve force. It's time for their baptism by fire.

This is the world of Warhammer: Shadow of the Horned Rat, a real-time strategy game that places you in charge of a mercenary army in a fantasy world filled with Dwarves, Elves, Orcs, and rat-like Skaven. Developed specifically for Windows 95 (but still compatible with Windows 3.x), Warhammer is a great example of what games can and should look like on that operating system.

The story of Warhammer is one of intrigue and evil. The Empire is threatened by the forces of a demon, the Horned Rat. To thwart him, you must hire troops and lead them into over 40 battles, each of which unfolds before you in spectacular fashion. The Super VGA 3-D graphics engine gives you a bird's-eye view of the action as you command your troops.

During battle, you'll have to issue a variety of orders to your armies (charge, retreat, and use magic items are among the more useful). It can get confusing, but Warhammer is a little easier to control than other real-time games (like Warcraft II and Command & Conquer) because your troops move in large, coordinated units.

The only drawback we saw was that the game gets too hard too fast. After the first four or five missions, you'll find yourself severely outnumbered in just about every battle. One word of advice: Protect your troops. If you suffer heavy casualties early on, you may not be able to get reinforcements for subsequent battles.

But even if you have to try some of the missions several times to win them, you won't mind replaying a battle in this excellent, addictive game. And if you had any doubts about Windows 95's viability as a gaming platform, Warhammer will squash them like so many Orcish troopers.

—Michael E. Ryan

IN AFTER HOURS

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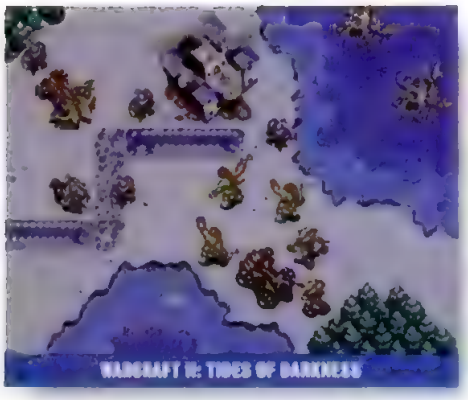
Warcraft II: Tides of Darkness

Blizzard Entertainment; 800-953-7669; http://www.blizzard.com.

Circle 442 on reader service card.

★★★★ $50

In the first war between the two civilizations, the Orcish Hordes drove the Humans from Azeroth across the Great



Sea to the lands of Lordaeron. The Humans had lost, but they were alive. Now, however, the Orcs have gathered allies, ships, and flying creatures to pursue the Humans. War has come again to the land of Orcs and Humans.

Thus begins the adventure of Warcraft II, the sequel to Warcraft: Orcs and Humans. Like the original, Warcraft II is a real-time strategy game in which you must complete a series of combat missions as leader of either Human or Orc forces. These missions range from simple patrols to complex amphibious invasions.

Building upon all the best elements of the first Warcraft game, Warcraft II adds enhanced Super VGA graphics and a host of new military units to control. On the Human side, you can now command Dwarves, Elves, Gnomes, combat ships, and a pair of flying units. Orcs have a similar array of units and weapons.

The game includes 28 scenarios split into two story lines (one for Humans, one for Orcs). Windows 95 users can also create their own scenarios using the built-in mission, unit, and sound editor.

Of the three games reviewed here, Warcraft II is the easiest to learn because of its friendly interface and cartoon-like characters. But don't be fooled—Warcraft II is a challenging game. Just controlling your often dim-witted troops is a challenge in itself. And if the cyber-foes aren't tough enough for you, try an eight-player IPX network game. (Two-player modem and direct-connect play are also supported.)

The one halfhearted complaint we have about Warcraft II is the limited map view. In large battles, especially those spanning multiple landmasses, it's easy to leave some troops idle as you concentrate your attention on others. You have to be quick.

Of course, this is a real-time game, so being quick is a prerequisite. Accepting that, you will find Warcraft II even more challenging, exciting, and addictive than its predecessor. —*MER*

Allied General

Strategic Simulations Inc.; 800-601-7529, 408-737-6814; http://www.ssionline.com.
Circle 443 on reader service card.
★★★★ $50

Your assault has faltered, and the Germans are counterattacking in force. If you don't regroup and hold, they'll drive right through you to Moscow. This is World War II, and the fate of nations is in your hands.

Allied General is the eagerly anticipated sequel to Panzer General, the critically acclaimed title that was complex enough to please hardcore wargamers and yet simple enough for the rest of us to enjoy.

Unlike the two real-time games reviewed here, Allied General is turn-based. One round at a time, you strategize your way through over 35 missions in 3 main campaigns: Russia, North Africa, and Western Europe. Critical battles such as Tobruk, Stalingrad, and the D-Day invasion of Normandy are included, along with some fictional scenarios. The missions are generally more difficult than those in Panzer General, especially in the Russian Campaign.

Other differences include a windowed interface that preserves space for the large, main map view. For instance, the overall strategic map can be called up in its own window when you need it and minimized when you don't.

Other than these evolutionary changes, Allied General plays much like its predecessor, right down to e-mail play. Two players can battle via e-mail by recording entire turns and sending them to each other.

Allied General was developed for Windows 95 but will run under Windows 3.1. A separate version is available for the Macintosh.

The only complaint we have about the game is that it might be a little too addictive. Allied General is an instant classic that more than lives up to its lineage.—*MER*

Earthworm Jim

CD-ROM PICK HIT

Groovy! That crazy, wise-cracking superhero-without-a-spine has made his way from game consoles to your PC. In this Windows 95 action-arcade game, you play the role of Earthworm Jim, a mild-mannered worm who acquires superpowers when a space suit lands on him. Now he's on a quest to save Princess What's-Her-Name. Along the way, he'll swing, shoot, and slither through 20 levels while fighting off Psy-Crow, Professor Monkey-for-a-Head, and Queen Slug-for-a-Butt (you think we're making this up?).

In case you haven't guessed, Earthworm Jim is overflowing with humor and fun, as players get treated to excellent graphics and lively music. If this game find its way onto the corporate desktops of America, it could mean the death of solitaire as we know it.—Michael E. Ryan

Activision; 800-477-3650; http://www.activision.com.
Circle 470 on reader service card.
★★★★ $49.95

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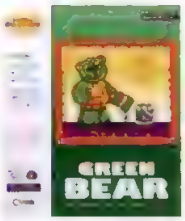

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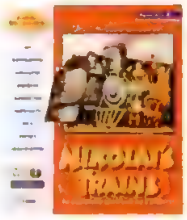

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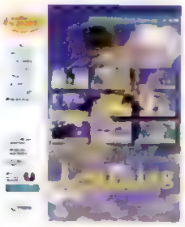

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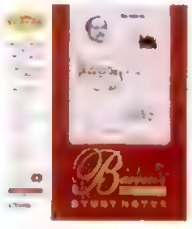

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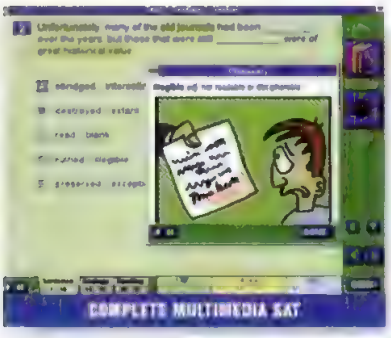
★★★

Self-education gets a much-needed boost from Chancellor & Dean's Complete Multimedia Course for the SAT. This simple but effective program uses a straightforward interface and a wealth of feedback to help students practice their math and verbal skills at their own pace.



The main interface is a desktop packed with math and strategy notebooks, a dictionary, vocabulary cards, practice tests, a remote control, and a progress log. Although the manual gives advice for getting started, the package has no set rules. Just point and click to access typical SAT math problems, a lengthy list of vocabulary words, or some basic advice on taking the test.

The multiple-choice

QUICK CLIPS

Recommended · It's Your Call · Not Recommended

Cosmology of Kyoto

Nothing if not unique, this fascinating historical adventure takes place in the demon-plagued streets of the imperial capital of ancient Japan. It was inspired by *The Tale of Genji* and other Japanese classics. $69.95; Dynaware USA Inc.; 800-711-3962.

Volcanoes: Life on the Edge

Another excellent title from Corbis. This one recounts the story of photojournalist Roger Russmeyer, who spent 14 months chasing active volcanoes. Hundreds of breathtaking images help tell the tale. $50; Corbis Corp.; 800-336-2947.

Edward Lear's Book of Nonsense

On the 150th anniversary of the original work, this small book and CD-ROM are fun and funny. The CD-ROM's animations and music bring the book's silliness to life. $24.95; Maxima New Media; 800-667-4988.

? CyberMage: Darklight Awakening

A first-person comic-book action/adventure game with great graphics. It uses *way* too many keyboard controls, and the graphics engine is a little rough around the edges, but the game is fun. $60; Origin Systems; 800-245-4525.

Too Real for the Office

PC Magazine September 26, 1995

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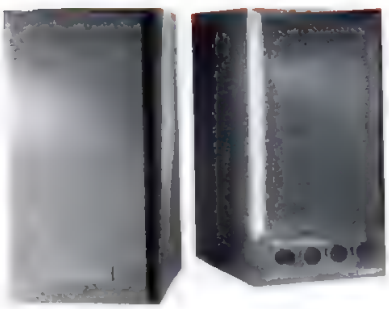

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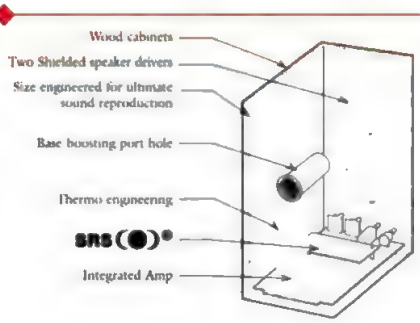

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SPOTLIGHT ON

On the Road With B.B. King

For decades, B.B. King has successfully brought the blues to new audiences, paving the way for other musicians. Now he's doing it again on the PC. On the Road With B.B. King is an extraordinary autobiographical CD-ROM that any blues fan will love.

On the Road is a hybrid CD-ROM that works with either Windows (3.*x* or 95) or Macintosh computers and runs directly off the CD-ROM. The entire title is beautifully rendered in both 256 colors and 16-bit color for higher-end machines.

As the program opens, you'll find yourself in the driver's seat of Big Red, B.B.'s famous tour bus. Right away, you'll notice one thing about this program that is lacking in most other musicians' CD-ROMs: the artist. Video clips of B.B. are with you every step of the way, as he tells anecdotes and guides you through the program. By the time you've explored the entire title, you'll feel as if you've known the man for years. You'll also know his music, as over 40 songs are incorporated into the title.

The title is broken up into five main sections, each centered on an important

location in B.B.'s life. In "Indianola, Mississippi," for example, you'll see where Riley B. King was born and hear how he played gospel tunes on the street corner. Moving on to "Beale Street," you'll hear Rufus "The Dog" Thomas talk about B.B.'s first radio gig (our favorite story on the CD). You'll also learn how Riley became first the Beale Street Blues Boy and then B.B. King.

You can either move about the sections freely, clicking on different areas to move toward them, or play the story associated with each section. The stories are narrated by B.B., and each is brilliantly illustrated by a different artist.

This CD-ROM is a must-have for blues fans, but anyone with an appreciation for music will enjoy it.

—Michael E. Ryan

MCA Records; 818-777-4000; http://bbking.mca.com.

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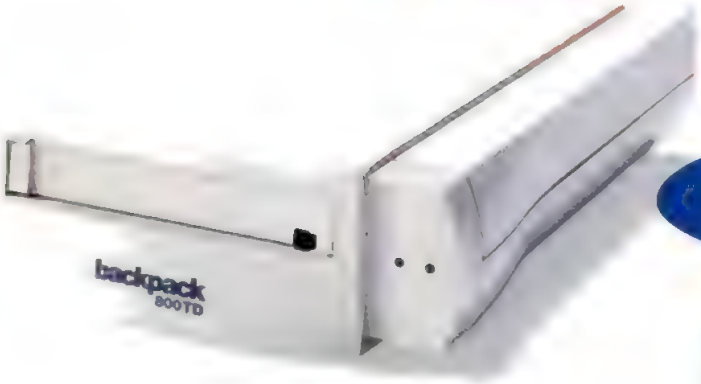

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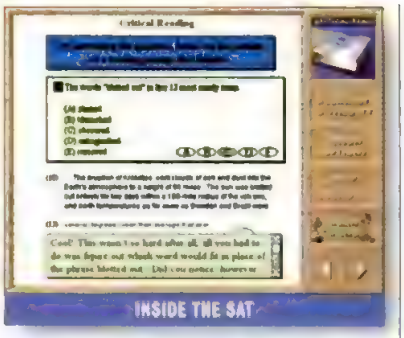
CIRCLE 856 ON READER SERVICE CARD

math questions include special tips as well as visual step-by-step problem solving and voice-overs, which serve to ensure comprehension. The vocabulary section is set up much the same way, with the addition of the Vocabulator. This electronic flash card creates a word list, tracking problem words and automatically linking to the dictionary. The package's voice-overs are particularly helpful in the verbal section, because the words are first pronounced and then used in sentences.



Each of the four practice tests in the program can be taken under timed testing conditions or used for review purposes. We liked the option to go back over incorrect answers with the aid of a "coach." This helps reinforce learning as though the student were working one on one with a tutor.

Self-motivated students who are aspiring to polish their skills and who need extra practice on the SATs would do well to try out this package. —*Mary Paulson*

Inside the SAT

ReviewWare; 800-336-0035; http://www.review.com.

Circle 472 on reader service card.

★★★★ WIN WIN 95 $29.95

The Princeton Review has long been associated with excellent SAT preparation courses that not only teach basic skills and concepts but also explain the structure and procedures that make up the test. With Inside the SAT, The Princeton Review has brought this information and guidance to the PC in a funny and engaging format.

The program's interface depicts a typical high school hallway complete with animated students and teachers. Clicking on a door leads to classrooms where you can learn verbal and math skills, take practice tests, see a guidance counselor, and go over general strategies. The helpful introduction walks you through each room and explains the strategies behind the Princeton Review course.

Like Chancellor & Dean's package, this program tracks the student's progress and keeps records for review. It also includes step-by-step drills, voice instruction, and strategy lessons. Unlike the Chancellor & Dean package, Inside the SAT offers extensive advice on the college application process, test score comparisons with students at 300 colleges and universities, and an extra section on the PSAT. Inside the SAT also costs considerably less.

The course is presented in an offbeat comic-book style that makes preparing for the SAT fun and less stressful. Inside the SAT constantly reminds students that the SAT is just a test and one that can be studied, learned, and anticipated. The attention to the college-entrance process is a welcome shift from the near-maniacal focus on the SAT as a maker or breaker of young lives.—*MP*

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Building The Ultimate Visual System

With the recent boom in multimedia, everybody wants crystal clear graphics that display instantly. But to get the ultimate visual quality, you need to build a visual system. The best tool to boost your computer's visualization is an add-in board called a graphics accelerator that dramatically improves graphics through greater resolution, color and speed. The result is better overall system performance. Current applications run faster, and shifts between applications and pages are quicker. Games, CD-ROMs and spreadsheets perform better and video playback is more vivid. Within the accelerator category, a range of solutions are available.

Let's say, for example, you have a computer with a 15" monitor that offers 800 X 600 resolution. For running small office applications like Microsoft® Excel, Microsoft Word, and some games, the best strategy is to find a 64-bit accelerator. Make sure the accelerator is compatible with your computer's bus, or the pathway connecting the new card to the computer's microprocessor. If your computer is a Pentium, it probably uses a PCI bus. A VL-bus is usually found on a 486, while older computers are likely to have an ISA bus. 64-bit accelerators in this category include the Diamond Stealth64 Graphics 2000 Series (VLB and PCI), and the SpeedStar 64 Series (ISA), both between $100 and $150.

To take advantage of applications incorporating video, like multimedia encyclopedias, opt for a multimedia accelerator. On top of improved 2D graphics performance, a multimedia accelerator adds full-screen digital video playback, including software MPEG, to your visual system. You'll want to select a multimedia accelerator that provides at least 2MB of DRAM. In doing so, you'll be geared up to support 16.7 million photo-realistic colors at a resolution of 800 X 600. Be sure a multimedia accelerator supports your operating system and includes software to customize your desktop with features like resolution switching on-the-fly. For example, the Diamond Multimedia Stealth64 Video 2001 Series

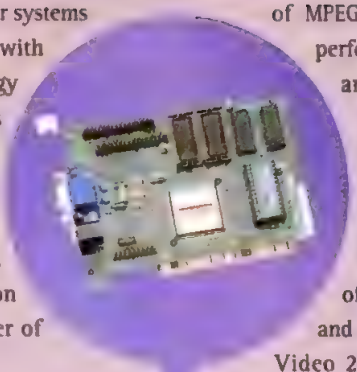
What Makes A Visual System

incorporates all these features, at a starting price of $150. Stealth products feature Diamond's InControl Tools desktop productivity software, and support most operating systems, including Windows® 95.

If you are using more graphically intensive programs or are using a larger monitor with high resolution, such as 1280 X 1024, you should consider a multimedia accelerator with faster memory, such as VRAM, for more visual horsepower. The more video memory the higher color depth and greater resolution your system can achieve. This breathes new life into entertainment and business applications. Look at the Diamond Stealth64 3000 Series, which incorporates all these features at a starting price of $299.

I Want My PC TV

Some of the hottest computer systems today are those equipped with MPEG video. MPEG technology compresses and decompresses digital video to deliver full-motion, full-screen digital video playback with realistic clarity, color and resolution. The ability to utilize video on a computer offers a number of potential uses.



Using video to educate and train via the computer allows people to learn through actually seeing the lesson, providing detail and intimacy that text alone cannot provide. In the realm of entertainment, exemplary benefits of MPEG lie in the online arena. The Internet and commercial online services are loaded with video clips of favorite actors, musicians and politicians. With MPEG, those video clips can be viewed at full-screen with full-motion.

One point of distinction within the MPEG world is hardware versus software. MPEG software is much more common. But for refined or higher quality video applications, hardware MPEG is the answer. Hardware MPEG guarantees a consistent rate of playback (delivering remarkably clear playback of MPEG-1 video clips), improved performance on slower systems, and the ability to listen to CD-quality MPEG audio. For example, Diamond's MPEG Video Player 1100 Series daughtercard, at $129, offers the additional performance of hardware MPEG technology, and is available for the Stealth64 Video 2001 Series of multimedia accelerators.

The new TV tuner technology takes the marriage of video and computers even further by adding another level of flexibility and immediacy to computing. This technology allows a broadcast or cable TV signal to be converted into a live television picture on your monitor, and also provides single frame or video clip capture functions.

The ability to watch and capture pieces of CNN or CNBC opens endless possibilities. Imagine having part of your screen dedicated to a stock quote broadcast while working on a PowerPoint presentation. Diamond's DTV 1100 TV tuner, at $129, is an upgrade option for the Stealth64 Video 2001 Series of multimedia accelerators.

S3 delivers customized PC multimedia

S3, the leader in graphics chips for the PC, developed the Cooperative Accelerator Architecture. This architecture includes the Trio64V+ graphics and video accelerator, the Scenic/MX2 MPEG decoder, and the connection between these chip technologies, the Scenic Highway Local Peripheral Bus. The flexibility of its design provides for a variety of multimedia accelerator configurations that improve the performance of multiple operating systems as well as business, professional and entertainment applications. The first Diamond product designed to take full advantage of the Cooperative Accelerator Architecture is the Stealth64 Video 2001 with 2D graphics, full-screen video and options for hardware MPEG and TV tuner/video capture.

"Computing is more visual than ever before."

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New Dimensions In 3D

Taking the industry by storm in 1996, 3D technology goes one step beyond standard multimedia accelerators. A 3D multimedia accelerator cranks up an operating system beyond its 2D cousin and brings a completely new graphics dimension to computing. Multimedia presentations incorporating 3D offer more detailed demonstrations, delivering more impact than standard 2D graphics. With 3D accelerators, 3D worlds on the internet are more realistic. For gaming aficionados, 3D signifies a new level of immersion and interactivity. The technology allows for crisper graphics at resolutions as high as 1024 X 768. Better 3D accelerators also support the special effects used in the newest 3D games, including texture mapping and perspective correction.

Choosing a 3D multimedia accelerator today prepares you for future applications. Many are designed specifically for Windows 95, so be sure the 3D accelerator you choose supports all of the Microsoft DirectX APIs that game developers worldwide are supporting. Many 3D multimedia accelerators are multi-function, and have such features as real time 3D and 2D photo-realistic graphics, full-screen, full-motion digital video and hardware wavetable audio engines. You'll also want a cool selection of games and software titles bundled in the package. Designed for Windows 95, the Diamond EDGE® 3D multimedia accelerator incorporates all of these features, and comes with Sega Saturn® compatible control pads*. Starting at $249, it is bundled with the Sega® titles Virtua Fighter™ Remix, Panzer Dragoon™ and NASCAR® Racing from Papyrus.

For more information on visual systems contact Diamond at http://www.diamondmm.com

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Communications are not what they used to be. Sophisticated communication tools were the spoils of big business only. Small business struggled using multiple phone lines and a desk cluttered with specialized devices – out of the office meant out of touch. Last year, 9.2 million Americans called themselves telecommuters, and today blank stares go to those without an e-mail address. Advanced communication is here...as long as you know how to get connected.

The answer for many telecommuters and home-based businesses lies in powerful, integrated multimedia communications systems. A comprehensive product delivers complete Internet access, file transfer, fax, voice messaging and e-mail, as well as transfer rates to 28.8 Kbps and beyond. Such a solution can also distinguish between incoming fax, data and voice calls on the same line. Conveniences important to small business such as: remote network access, caller ID, alpha-numeric LCD display, and pager notification of messages are also available.

The development of modems that handle voicemail and fax means cutting the costs associated with additional equipment, services, personnel and phone lines. At higher speeds, the cost of long distance calls, Internet access fees and time spent online drop significantly. Being wired to the broad base of the World Wide Web also presents exceptional promotional opportunities for small business. For example, an interactive magazine combining text, graphics, sound and video can be produced at a reasonable price. The Supra Communications Division of Diamond Multimedia, Inc. offers all these features in the SupraSonic 288V+, an integrated multimedia communications solution priced as low as $299.

Rules for the road

Don't access the Internet at less than 28,800 bps unless you're ready for a nap.

The higher your transfer rates, the lower your access fees and long distance charges.

The better the compression technology, the faster your transfer rate.

Look for features such as headset support, caller ID, and message notification by pager, fax or phone.

Remote access to fax and voice messages will help you keep in touch while you're out of the office.

The details count! A solution which includes all the cables you need in a single package saves you time and money.

State-Of-The-Art Integrated Modem

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What to do on the Internet

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- Look for a job
- Visit new countries
- Play video games
- Send mail around the world
- Visit the Smithsonian
- Chat with friends in Europe
- Browse libraries
- Listen to new music
- Read encyclopedias online
- Publish your artwork or writing
- Read product reviews

"What does it take to surf the Net, send and receive e-mail, and download that Web page everyone is talking about?"

Jumping On The Internet — Without Falling

The Internet is leading the connectivity charge. But with all the buzz about the Internet, many people are still relatively confused about what it all means and how to take advantage of it properly. Lively conversations about the hottest Web sites and who is the best Internet provider do not include how to get online without headaches and hassles. What does it take to surf the Net, send and receive e-mail, and download that Web page everyone is talking about? One of the simplest solutions is to get a comprehensive Internet kit that offers everything needed to get wired quickly and painlessly.

There are kits available that offer only partial solutions – a lower speed 14.4 Kbps modem and a variety of Internet software, or shareware with an off-the-shelf Internet book not specifically related to the product. A complete solution will have you surfing quickly and simply because the modem, software, Internet service provider and manuals are designed to work together seamlessly.

To reduce Internet access fees and prevent watching your screen download a single file for 15 minutes, choose a high-speed, 28.8 Kbps modem. To take full advantage of the speed, you also want to connect with an Internet service provider that can be accessed at 28.8 Kbps (not all of them can). Your provider should also have local access numbers in your area so you're not paying a long distance fee, and enough ports to handle a host of customers without half of them getting busy signals. You'll also want to ensure that your kit comes with one software program that encompasses all the primary services the Internet offers: e-mail, the World Wide Web, Gopher, USENET and FTP. Finally, while it will be simple to hop on the Internet with a good kit, make sure the documentation and manuals provided are customized to address all the items in that kit specifically. All the features required for easy Internet access are available in Supra Simple Internet 288. This comprehensive solution, over a $300 value, is priced well under $200 and includes a CD-ROM tutorial and Internet Directory.

"The Internet is leading the connectivity charge."

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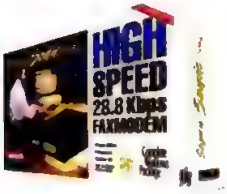

The SupraSonic 288V+

If you're a professional or serious user, you'll want the performance and messaging capabilities of the SupraSonic 288V+, a fax/voice/data modem. Small or home-based businesses will find extremely useful features like: a headset, an intuitive LCD display, caller ID, fax-on-demand, remote access to faxes and voicemail, and all necessary cables.

Supra Simple Internet 288

Integration. That's the key to finding the right Internet kit. Supra Simple Internet makes getting on the Internet easy using a 28.8 Kbps modem, Supra Mosaic software, customized manuals, a CD-ROM tutorial, fax software and all cables.

SupraExpress 288i PnP

This economical solution offers dependable 28,800 bps communications and the ease of plug-and-play installation. Configuration is automatic whether you're running Windows 3.1 or Windows 95. Complete Windows solution for fax, Internet and file transfer.

For more information on communications contact Supra at http://www.supra.com

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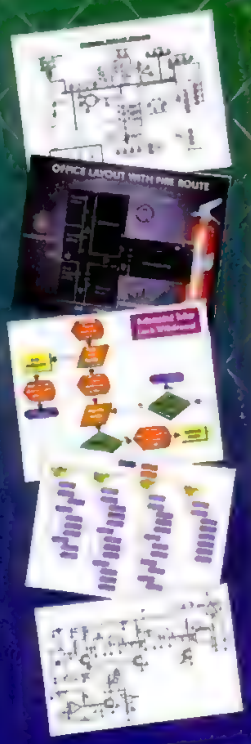
CorelFLOW 3 BEATS VISIO 4!



FEATURE	CorelFLOW 3	Visio 4
Symbols	6,400+	1,000+
Smart Symbol Libraries/Stencils	205	29
Fonts	150	0
Clipart	1,500+	0
Photos	1,000	0
Live repeating line patterns	YES	NO
Polygon tool	YES	NO
Fountain fills	YES	NO
Center and repeating arrows	YES	NO
Hyperlinks	YES	NO
Dynamic print preview	YES	NO
Multiple shadows	YES	NO
Thesaurus and Type Assist	YES	NO
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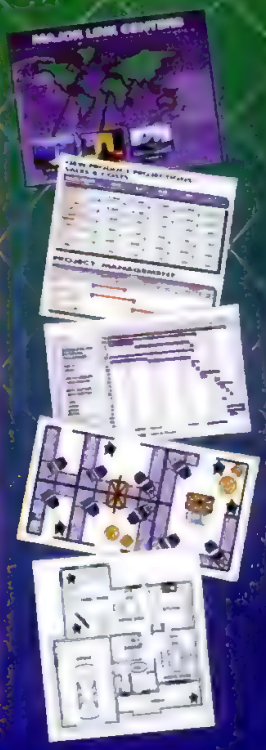
Script editor	YES	NO
Number of color models supported	8	2



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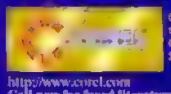

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Coming Up

Home PCs

PCs designed for the home usually offer more amenities than standard business machines: They come with more "free" software, multimedia capabilities, plus better setup instructions, and even customized tutorials or instructional videos to help you work your way around your new PC. We're testing 11 home PCs from this market's leading vendors, evaluating them on their ease of setup, the quality of their sound systems and bundled software, and, of course, their performance.

The Web Within

A new platform for collaborative computing has emerged: the *intranet*. Based on the open standards of the dynamic World Wide Web—instead of the technology of a single vendor—intranets promise information-sharing solutions that are inexpensive and scalable. But can Internet technologies really provide a better way to work than well-known groupware systems like Collabra, GroupWise, and Lotus Notes? *PC Magazine* provides an overview of the intranet phenomenon and what such vendors as Lotus, Microsoft, Netscape, and Novell are developing for intranets. We review four collaboration solutions for Web servers and four products for Web-enabling proprietary information bases. And we also give you guidelines on how to deploy your own corporate intranet.

PIMs

Have you been searching far and wide for the perfect product that will schedule your appointments, keep track of your contacts, and keep all important information within easy reach—essentially, organize your life—whether you're at work, at home, or on the road? Well, enough information management packages exist in the market today for you to find one that jives with your life quite nicely. We look at how well 18 products perform contact, task, and information management as well as calendar scheduling, workgroup functions, and remote synchronization. We also take a walk down memory lane to look at these information managers' predecessors—PIMs, contact managers, and network schedulers.

Lotus Notes 4.0

After a long wait, Lotus Notes 4.0 is here. But what does its arrival herald for developers? We look at new options for updating your existing Release 3 Notes applications, as well as what Notes 4.0 offers for building new ones with better performance and UI features. We also look at Notes' new Web features and strategy, which represent a massive change of direction for the most widely used groupware product.

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Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott

Watch Out, Mike! 125 Million People Really Want to Spank You Right Now

Cranky old Mike Royko of *The Chicago Tribune* had this to say recently: "Unless you are already an experienced user, save yourself a lot of hair-pulling grief and buy a Mac. It does everything easier and better than all those other clunky things that have made Bill Gates rich. Anyone who tells you otherwise is a sadist, a masochist, or both."

Crystal Clear Sound Co. (310-529-3969) presents the 55-gallon PC aquarium for about $1,200. Is this idea all wet?

Classified Intelligence

"NOVELL. Seeking candidate to install, troubleshoot, and build a sewer. Long term w/potential."—*THE PATRIOT NEWS* (HARRISBURG, PENNSYLVANIA)

RICHARD TENNANT

NetWare got you down? Maybe Pepto-Bismol would help. (Learning Tree ad.)

From the Department of Honesty in Documentation

"Insert The 11th Hour: The Sequel to the 7th Guest disc into your CD-ROM drive (because inserting it into a floppy drive causes a serious performance drop!)"—THE 11TH HOUR INSTRUCTION MANUAL

Hey, here's a class that would be perfect for Mike Royko! (Gainesville [Florida] Community College flyer.)

Start with an introductory curse, then learn the operating system, then specialize in WordPerfect or Lotus or another software package!

Tom Rawson
President/CEO/Human
Jp Software Inc
PO Box 1470
E Alington MA 02174

Wow. This mailing-label software really gets to the heart of the matter.

If your entry is used, we'll send you $50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: Chris Dalton, Ron Matuska, Joel Millner, Suzanne Perry, Tom Rawson, and Ray Roberts.

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